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FLEXCROP: A Dryland Systems Model

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Abstract

Wind and water erosion and development of dryland saline seep areas in the northern Great Plains have accentuated the need to replace the crop-fallow system of farming with a more intensive and flexible cropping system. A flexible cropping system should consider the amount of plant-available soil water at seeding time; estimated average growing season precipitation; and grower management factors, such as crop to be grown, variety, crop rotation, weed and insect problems, soil fertility, and planting date. A dryland cropping system computer model, "FLEXCROP," was developed to help farm managers evaluate the effects of their crop and soil management decisions on potential crop yield and to help them decide whether to recrop or summer fallow a given field. The model includes most of the factors listed above that should be considered to make a flexible cropping decision. Winter wheat, spring wheat, barley, oats, and safflower are the crops covered in the current model. FLEXCROP is being used by Montana and North Dakota Cooperative Extension Service personnel to help farm managers make crop and soil management decisions. FLEXCROP is available to each county extension agent through the AGNET computer system (a multi-State computer network). The model is discussed in this publication.

Keywords: Flexible cropping, recropping, winter wheat, spring wheat, barley, oats, safflower, summer fallow, soil fertility, crop rotation, weed competition, plant-available water, estimated crop yield.

Contents

	Page
Introduction	1
Model	1
Previous crop	2
Crop selection	2
Estimating plant-available water	2
Base yield	3
Variety selection	4
Weed competition	4
Soil fertility and fertilizer requirements	6
Planting date	7
Yield summary	7
Economic analysis	7
Limitations	7
Literature cited	9
Appendix A: BASIC program listing	11
Appendix B: Location of weather recording stations, cropping districts, and monthly precipitation	45
Appendix C: References used for economic module	47
Appendix D: FLEXCROP variables used in BASIC program	48

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FLEXCROP: A Dryland Cropping Systems Model

A. D. Halvorson and P. O. Kresge¹

Introduction

Wind and water erosion problems along with the development of saline seep areas in the northern Great Plains have made the crop-fallow system of farming undesirable as a farm management practice (8, 22, 26, 27). During idle periods of fallow between crops, soils often lack sufficient protective crop residue and are highly susceptible to wind and water erosion. During either a 14- or a 21-month fallow period, the soil is generally devoid of growing vegetation, and loss of water by evapotranspiration is minimal. As a result, water losses to deep percolation occur below the root zone in a small grain-fallow cropping system (22, 27).

Halvorson and Reule (28) found that alfalfa minimized the deep percolation losses of soil water and effectively controlled saline seeps. Data of Brown et al. (15, 16) indicate that small grain and oilseed crops effectively use root zone available water and growing season precipitation and minimize loss of water below the root zone. Production of small grain or oilseed crops more often than every other year on soils affected by saline seep would reduce the loss of water during fallow by deep percolation, reduce saline seepage, and increase water-use efficiency. Therefore, soil and water resources could be conserved by cropping more frequently than has been done with the crop-fallow system commonly used in the northern Great Plains.

As an alternative to summer fallow cropping, a flexible system of cropping— which considers the amount of plant-available soil water at seeding time; an estimate of growing season precipitation; and grower management factors, such as crop to be grown, previous crop, weed problems, soil fertility, and planting date—is needed to effectively reduce the loss of soil and water. Summer fallowing should be done only when water is so deficient that the probability of producing a profitable crop is low. Our objectives were to develop a crop production model to assist growers in making management decisions on whether to recrop or summer fallow a given field and to suggest what management is needed to produce a given yield and profit.

Model

A flow diagram of the computer model is shown in figure 1. The model considers plant-available soil water estimated at seeding, estimated growing season precipitation, previous crop, crop to be grown, crop variety, weed problems and methods for control, soil fertility and fertilizer needs, and planting date. A summary at the end of the program shows how each factor or management decision potentially affects grain yield. The user can also input expected economic cost and return data and get a partial analysis of potential income. Estimates of potential crop yield, costs, and prices can help the producer decide whether to recrop or fallow a given field. The model currently considers winter wheat (*Triticum aestivum* L.), spring wheat (*Triticum aestivum* L.), barley (*Hordeum distichon* L.), oats (*Avena sativa* L.), safflower (*Carthamus tinctorius* L.), and fallow as management alternatives.

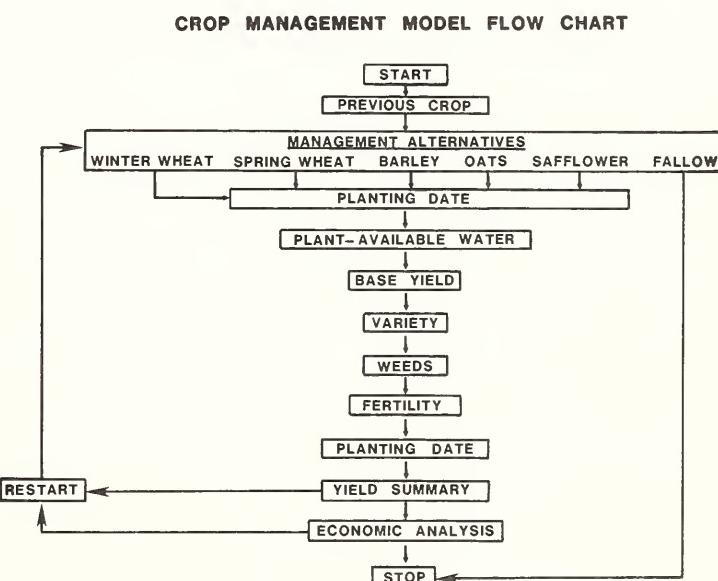


Figure 1.—Computer flow chart of the FLEXCROP crop management model.

Information used to develop the model was obtained from data published in technical journals and research reports and from unpublished research data of and personal communications with scientists in North Dakota and Montana. Where information was lacking, responses were estimated from personal experiences of researchers. The current model provides a basis from which more comprehensive models could be developed.

In the model, a percentage yield increase or decrease, starting from the base yield, is calculated as each management factor is considered. The percentage change

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²Italic numbers in parentheses refer to Literature Cited, p. 9.

is based on the estimated yield from the previous management factor. Many possible interactions have not been considered because information representative of the northern Great Plains was lacking. As new or better information becomes available, it will be incorporated in the model to improve the accuracy of its yield estimates.

A listing of the program (written in BASIC computer language) is given in appendix A. The entire program is divided into nine sections or modules to allow use on small portable minicomputers. The program operates by using a CHAIN function to change from one module to another. "HELP" statements are provided throughout the program to provide brief explanations about the type of information being requested. In addition, a user's manual has been prepared (31).

Previous Crop

Proper crop rotation minimizes disease, weed, insect, and possible residue phytotoxicity problems in flexible cropping systems with or without fallow; therefore, the same crop should not be grown on the same land 2 years in succession (3, 24, 30). Users are asked to enter the previous year's crop for the field in question. This information is used during the crop selection routine. The user is warned that yield reductions will result if the same crop is grown on the same field 2 years in succession. A yield reduction of 5 percent results for spring wheat following spring wheat or winter wheat following winter wheat, 2 percent for barley following barley, and 10 percent for oats following oats (30). Safflower following safflower or any other oil seed crop is not recommended, and results in a 50-percent yield reduction (3) (personal communications with J. Bergman, Montana Agricultural Experiment Station, Sidney). Fallowing the same field 2 years in succession is unacceptable and terminates the program.

Crop Selection

Crop selection is based on available soil water at seeding and the previous crop. This section of the program attempts to match the crop with available soil water supplies to minimize the risk of a crop failure. Brown et al. (14) established the following guidelines for selecting the most desirable crop based on available soil water at seeding: (1) spring wheat and barley could be grown with a minimum of risk with about 3 inches of available soil water; (2) oats, with no less than 1 inch of available soil water; and (3) safflower and winter wheat, with about 2 inches of available soil water. A warning is printed when soil water conditions are too low for the crop selected and risk of crop failure is high. At this point, the program user has the option of selecting another crop or proceeding with the crop originally selected.

Estimating Plant-Available Water

The quantity of stored soil water is the production factor most related to crop growth and grain yield (1, 2). Therefore, soil water at seeding must be considered when estimating yield potentials. Soil-testing laboratories in North Dakota, Montana, and Saskatchewan take into account the amount of available soil water when making fertilizer recommendations (14, 34, 36, 39).

In the model, plant-available soil water at seeding time is entered from actual soil water measurements or is estimated by measuring the depth of moist soil with a probe (13, 14) and converting this measurement to inches of soil water based on the amount of water held by soils of various texture. By knowing the depth of moist soil and soil texture, available soil water is estimated in the model using the following guidelines (13, 14, 23, 39): (1) coarse-textured soils hold about 0.8 inch of plant-available water per foot of moist soil depth; (2) medium-textured soils, about 1.5 inches per foot; and (3) fine-textured soils, about 2 inches per foot. The textural groupings, model code, and corresponding level of plant-available soil water as used in the model are reported in table 1. For spring seeded crops, the depth of moist soil should be measured in the spring after the soil has completely thawed, preferably after April 1.

Table 1.—Estimated plant-available water per foot of moist soil at field capacity

Textural group	Model code	Textural class	Plant available soil water
Inches/foot			
Coarse	C	Fine sand, loamy sand	0.8
Moderately coarse	MC	Sandy loam, fine sandy loam	1.5
Medium-fine	MF	Loam, silt loam, clay loam, silty clay loam, silty clay, clay.	2.0

Growing season precipitation is estimated from long-term U.S. Weather Bureau records (38), which are accessed from a stored computer file. The user can either input the name of the nearest location with precipitation records or input the expected local growing season precipitation and known cropping district. A list of the 131 Montana locations stored in the computer is given in appendix B along with mean monthly precipitation and cropping district. Growing season precipitation and soil water are considered to be equally available in this model.

For spring crops, growing season precipitation is assumed to equal average rainfall received from 10 days after seeding to July 31 if the soil profile is at

field water holding capacity to a depth of 4 feet. If the soil profile is not wet to a 4-foot depth, growing season precipitation is assumed to equal the average rainfall from time of soil water measurement (which is assumed to be later than April 1) until July 31. For this model, precipitation is assumed to be distributed equally among days of the month; therefore, the precipitation for a partial month is calculated as a fraction based on number of days.

For winter wheat, growing season precipitation is assumed to equal average precipitation from fall seeding until June 30 with the following adjustments: (1) under fallow conditions, with the soil not at field capacity to a 4-foot depth, 12 percent of the seeding to April 1 precipitation is assumed; (2) under fallow conditions with a full soil water profile, no credit is given for precipitation received from seeding to April 1; (3) 33 percent credit is given for standing stubble; (4) 25 percent, for worked stubble; and (5) 48 percent, for a grass barrier system (4).

Total plant-available water is estimated to be the sum of plant-available soil water and average growing season precipitation. An initial yield is calculated based on the amount of total plant-available water (see "Base Yield" below). Users have the option of inputting their own estimate of growing season precipitation if desired.

Base Yield

'Cheyenne' winter wheat, 'Thatcher' spring wheat, 'Compana' barley, 'Gopher' oats, and 'S208' safflower are used as the check varieties to calculate a starting maximum yield potential, based on the amount of plant-available water. The base yields are calculated from linear regression relationships established between yield and plant-available water. These relationships were developed from long-term small grain variety trials and yearly precipitation records obtained from work done by G. P. Hartman (research reports, 1952-78, Montana Agricultural Experiment Station, Sidney). These variety trials were conducted on fallowed soils, adequately fertilized, and weed free. Plant available soil water was assumed to equal 6 inches each year. The linear equation for 'Thatcher' spring wheat was $Y = 6.05(W) - 32.0$, $r = 0.84$, where Y is yield in bu/acre, W represents the inches of total estimated plant-available water, and r is the correlation coefficient (fig. 2). Years of severe disease problems (generally wet years) were excluded from the regression analysis because of reduced yields during these years.

The linear relationships between plant-available water and grain yield for 'Compana' barley (fig. 3) are: $Y = 9.32(W) - 42.6$, $r = 0.78$; for 'Gopher' oats (fig. 4), $Y = 13.67(W) - 73.6$, $r = 0.82$; and for 'Cheyenne' winter wheat (fig. 5), $Y = 6.50(W) - 39.8$, $r = 0.85$. Approximately

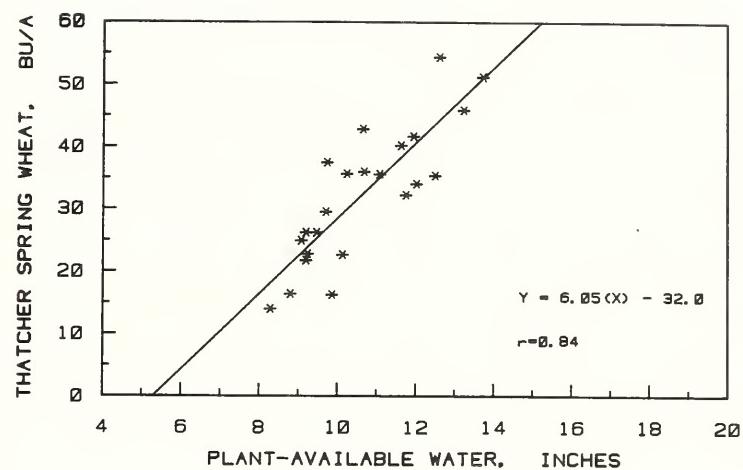


Figure 2.—Thatcher spring wheat yield as a function of estimated plant available water.

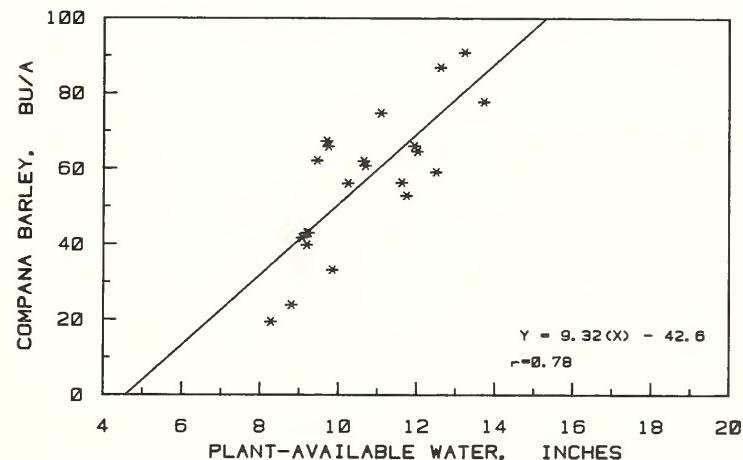


Figure 3.—Compana barley yield as a function of estimated plant available water.

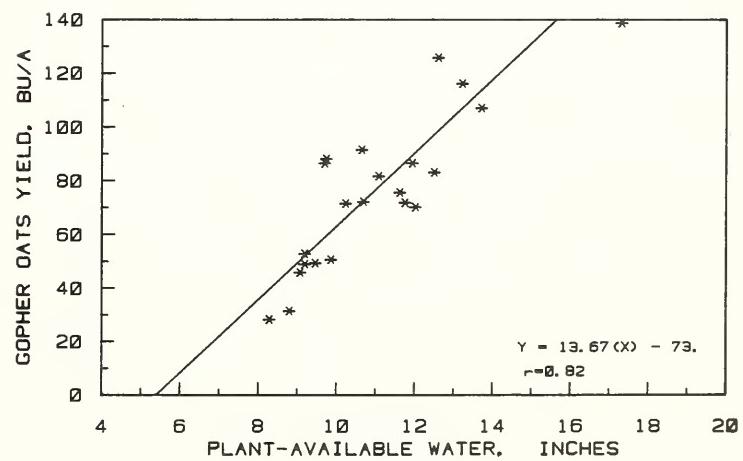


Figure 4.—Gopher oat yield as a function of estimated plant available water.

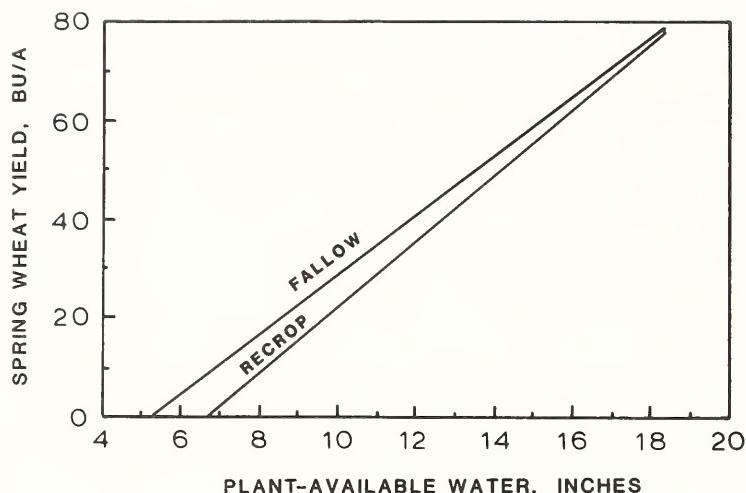


Figure 5.—Cheyenne winter wheat yield as a function of estimated plant available water.

6.1, 5.3, 4.6, and 5.4 inches of plant-available water are needed to produce the first bushel of winter wheat, spring wheat, barley, and oats, respectively. These quantities agree with the work of Staple and Lehane (37), who reported that no grain was produced when evapotranspiration was less than 5 to 6 inches.

Potential safflower yield estimates were obtained from yield-precipitation relationships developed by Bergman et al. (3). The safflower subroutine still needs refinement; however, current model estimates appear to predict yield reasonably well. Safflower grown on fallowed soils yields about 2,000 pounds per acre, compared with about 1,500 pounds per acre under recrop conditions (3). With less than 6 inches of available soil water, recrop safflower yields will be less than maximum. If soil water is less than 6 inches, a relative yield reduction factor, R, is calculated based on the following equation: $R = 0.13(\text{soil water}) + 0.22$, $r = 0.99$ where soil water is in inches and R is a fraction of the established yield at this point in the program. For this model, R cannot be greater than 1.

Small grain yields under recrop conditions are generally less than those from fallow. The difference between recrop and fallow crop yields is greatest at low moisture and least at high moisture levels (fig. 6). An adjustment equation was developed from information obtained in eastern Montana by A. L. Black and G. P. Hartman (personal communication). The recrop yield equation is: Recrop yield = $Y - [-0.1(Y) + 9]$, where Y equals the estimated fallow yield in bushels per acre obtained from the relationships reported in figures 2 through 5.

Variety Selection

The relative performance of small grain varieties can make as much as 2 to 17 percent difference in yield. The program lists the currently recommended varieties of the selected crop for a given cropping district. For instance, Montana has six cropping districts (fig. 7). The user can input the number of his or her cropping

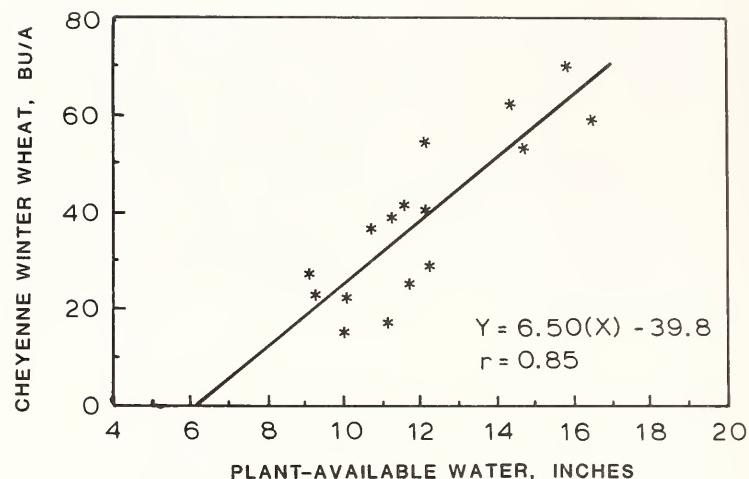


Figure 6.—Fallow and recrop spring wheat yields as a function of estimated plant available water.

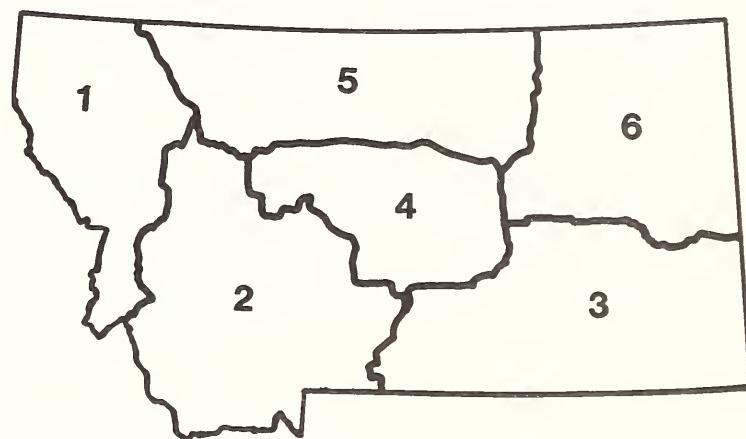


Figure 7.—Location of the six Montana cropping districts.

district, or it will be identified by the computer from the location name of the nearest weather records entered earlier in the program. The selection number for "other" is provided for the user who chooses a variety other than those listed; but because of insufficient performance data, the computer will use the base yield of the check variety.

Montana Agricultural Experiment Station results from variety trials were used to calculate a relative yield ratio for each of the recommended varieties for each cropping district (tables 2, 3, 4, and 5). The relative yield ratio (yield of recommended variety to yield of check variety) is used to increase or decrease the base yield of the variety selected for each of the cropping districts (9, 10, 11, 12, 29). This information is stored as data statements in the program.

Weed Competition

Failure to control weeds will result in yield loss. Grain yields are reduced by weed competition according to the level of weed infestation. The program considers competition from wild oats (*Avena fatua* L.) (table 6) and a general grouping of broadleaf weeds (table 7). To

maintain simplicity, broadleaf weed populations were grouped into generalized categories using Canada thistle (*Cirsium arvense* L.) as an example of perennial weeds and wild mustard (*Brassica kaber* (DC.) Wheeler), and wild buckwheat (*Polygonum convolvulus* L.) as examples of annual weeds. Based on the number of weeds per square yard and type, the user decides whether he or she has a high, medium, low, or no weed problem. Estimated yield reductions for these general

Table 2.—Recommended hard red spring wheat varieties for cropping districts and yields relative to Thatcher

Code No.	Variety	Recommended in districts	Relative yield	
			Fallow	Recrop
1	Fortuna	1, 2, 3, 4, 5	1.047	1.026
2	Lew	6	1.094	.946
3	Manitou	6	1.011	1.010
4	Newana	1-6	1.170	1.117
5	Norana	1-6	1.130	1.137
6	Olaf	5, 6	1.124	1.119
7	Thatcher	1-6	1.000	1.000
8	Tioga	6	1.061	1.080
20	Other	—	1.000	1.000

Table 3.—Recommended barley varieties for cropping districts and yields relative to Compana

Code No.	Variety	Recommended in districts	Relative yield	Yield loss		
				Plants/yd ²	Wheat	Barley and oats
1	Compana	2, 3, 4, 5, 6	1.000	8	11	7
2	DeKap	2, 3, 4, 5, 6	1.146	42	24	16
3	Erbet	1-6	.892	83	34	23
4	Georgie	1-6	1.031			
5	Hector	2, 3, 4, 5, 6	1.095			
6	Horsford	1, 2, 4, 5, 6	.953			
7	Piroline	1-6	1.040			
8	Purcell	1	1.026			
9	Shabet	1-6	1.049			
10	Steptoe	1-6	1.093			
11	Summit	1-6	1.066			
12	Unitan	1-6	1.073			
13	Vireo	1-6	1.075			
14	Other	—	1.000			

Table 4.—Recommended oat varieties for cropping districts and yield relative to Gopher

Code No.	Variety	Recommended in districts	Relative yield	Yield loss		
				Plants/yd ²	Wheat	Barley and oats
1	Basin	1-6	1.047	8	11	7
2	Cayuse	1-6	1.169	42	24	16
3	Gopher	1-6	1.000	83	34	23
4	Kelsey	6	1.081			
5	Otana	1-6	1.124			
6	Park	3, 4, 5	1.043			
20	Other	—	1.000			

categories are based on information obtained from the literature (17, 21, 25, 32, 33, 35). For example, for an uncontrolled wild oat infestation of 42 plants per yard², medium rating, a 24-percent yield loss would be estimated for wheat. A yield reduction is not calculated for each weed type present. A single reduction in yield is calculated for all broadleaf weeds present. The amount of reduction depends upon the category chosen.

Yield data relative to the competitive effect of green foxtail grass (*Setaria viridis* (L.) Beauv.) are not readily available. For this reason, green foxtail grass competition has not been considered directly in computing yields. Green foxtail grass infestations are influenced by seeding date, row spacing, temperature, and precipitation. Chemicals are, however, available to control green foxtail grass in spring wheat, barley, and safflower.

Table 5.—Recommended winter wheat varieties for cropping districts and yields relative to Cheyenne

Code No.	Variety	Recommended in districts	Relative yield	Yield loss		
				Plants/yd ²	Wheat	Barley and oats
1	Centurk	3, 4, 5	1.166	8	11	7
2	Cheyenne	3, 4, 5	1.000	42	24	16
3	Crest	1, 2, 3, 4	1.002	83	34	23
4	Froid	5, 6	.924			
5	Lancer	3	1.065			
6	Minter	6	.937			
7	Roughrider	6	.975			
8	Trapper	3	.979			
9	Warrior	3, 4, 5	1.024			
10	Winalta	3, 4, 5, 6	1.018			
11	Winoka	3, 4, 5	.973			
12	Other	—	1.000			

Table 6.—Yield reduction from wild oat competition¹

Level of infestation	Plants/yd ²	Yield loss		
		Wheat	Barley and oats	Percent
Low	8	11	7	7
Medium	42	24	16	16
High	83	34	23	23

¹From Dew (21)

Table 7.—Example of competition from infestations of common broadleaf weeds

Level of infestation	Potential yield reduction	Perennials	Annuals	
			Canada thistle	Wild mustard
Low	10	1 to 2	5 to 25	5 to 50
Medium	15	2 to 5	25 to 50	50 to 100
High	25	5	50	100

Only grassy weed competition is considered for safflower production. Generally, broadleaf weeds have been controlled during small grain production and are not much of a problem in safflower. In addition, herbicides generally used for grassy weed control in safflower also control many of the common broadleaf weeds.

When requested, the program lists several of the most prominent weeds in the northern Great Plains along with several effective herbicides for controlling them (personal communications with Pete Fay, Montana State University, Bozeman). Application rates are not given and a warning is printed to "Read and follow the label exactly." When requested, specific information about several wild oat herbicides is provided.

Soil Fertility and Fertilizer Requirements

The user is advised that a soil test for N and P is needed to accurately assess the soil fertility status of the soil and to make the best estimate of N and P fertilizer needs. The user has the option of having soil test information for only N, only P (either Bray or bicarbonate extractable), both N and P, or no information. Fertilizer recommendations are adjusted according to the soil test level of N and P in the soil. If no soil test information is available, the program assumes low soil test levels of available N (30 lb N/acre to 4-ft. depth for recrop conditions and 70 lb. N/acre to 4-ft. depth for fallow) and P (7 ppm).

All Bray soil test values for P are converted to an equivalent bicarbonate-extractable P soil test level. This is done using the following regression equation:

$$\text{Bicarbonate P} = 0.19(\text{Bray P}) + 2.38$$

where bicarbonate P and Bray P are in parts per million. The data used to develop this equation were the corresponding soil test values for the very low, low, medium, and high categories for each P soil test. The P requirements are dealt with first and treated the same for all crops. The amount of P fertilizer needed to raise the soil test to an adequate level (16 ppm) is calculated from linear relationships established between added broadcast P and bicarbonate-extractable P (6 and unpublished data, A. D. Halvorson) (fig. 8).

Using the slopes of linear relationships, the amount of P fertilizer needed to raise the soil test to 16 ppm is calculated from the equations shown in figure 9 for two soil textural groups. The recommended P rate for band application is assumed to be 67 percent of the broadcast rate. The user is then asked to input the amount of P fertilizer that will actually be applied and method of application (banded, broadcast, or split). If less P is applied than that recommended, a yield reduction is calculated based on a new soil test level calculated from knowing the amount of P fertilizer actually applied. If the P was banded, the P rate is converted to a

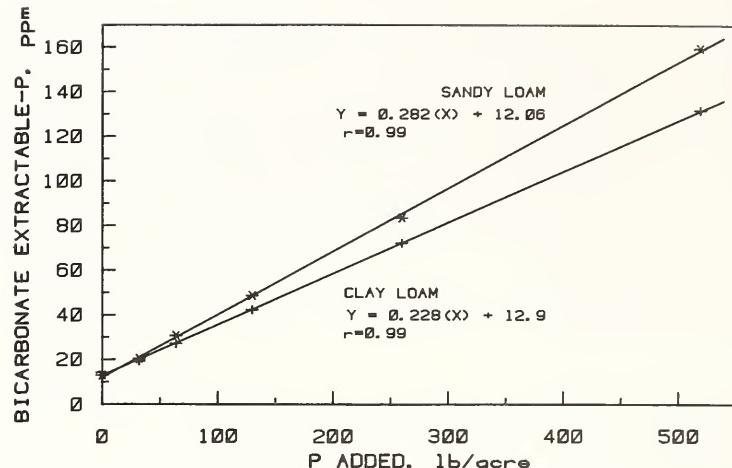


Figure 8.—Sodium bicarbonate extractable-phosphorus (0- to 6-inch soil depth) as a function of added broadcast P fertilizer and soil texture.

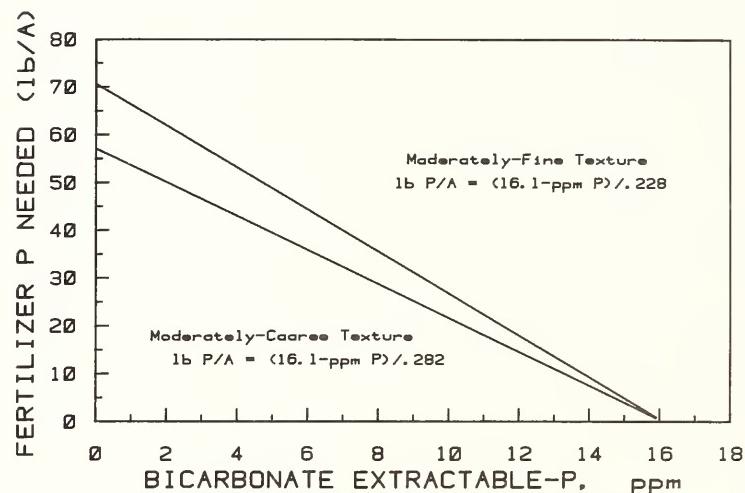


Figure 9.—Amount of broadcast fertilizer phosphorus (P) needed to raise the soil test P level to 16 ppm as a function of sodium bicarbonate extractable-P (0- to 6-inch soil depth) and soil texture.

broadcast equivalent before calculating a new soil test level. Any yield reduction from inadequate P fertilization is based on the following equation developed from unpublished data (A. L. Black):

$$\text{Percent of yield potential} = [4(P) + 36]$$

where P is the new calculated soil test level (must be less than 16) in parts per million.

After dealing with the P-fertilization subroutine, the N-fertilizer requirement for the estimated yield is calculated using the following equation (3, 5):

$$\text{NFR} = (Y \times \text{NR}) - \text{soil N}$$

where NFR is the N fertilizer required (lb N/acre), Y is estimated yield for small grains (bu/acre) or for safflower (lb/acre), NR is the N requirement per yield unit (lb N/bu or lb N/lb grain), and soil N equals the soil

$\text{NO}_3\text{-N}$ level (lb N/acre-4ft). The NR factor for spring wheat and winter wheat is 2 lb N/bu; 1.6 lb N/bu for barley; 1.1 lb N/bu for oats; and 0.05 lb N/lb grain for safflower. Reductions in yield due to inadequate N fertilization are based on the above N relationships.

Potassium is considered adequately supplied if no soil test data are available. If the soil test level for K is less than 200 ppm, 40 pounds per acre of K_2O is recommended. Micronutrients are generally not a growth limiting factor for small grains or safflower in the northern Great Plains; therefore, they are not considered.

Planting Date

Early seeding in the northern Great Plains generally results in higher yields than late seeding. This is partly due to the distribution of growing season precipitation, which is highest during May and June (7, 18, 19, 20). Early seeding also tends to result in larger responses to applied N and P fertilizer and less weed problems (particularly green foxtail grass). As seeding date is delayed, the absolute yield loss tends to be greater on high fertility soils with good soil water holding characteristics than on low fertility soils with poor soil water holding potential. Delayed seeding reduces yields 0.40 bushel per day under high fertility conditions; 0.21 bushel per day under medium fertility conditions; and 0.16 bushel per day under low fertility conditions for spring wheat, barley, and oats. In the model, yield reductions for spring grains begin accumulating after April 20 in central Montana and after May 15 in eastern Montana. Detailed seeding date data are not yet available for safflower; however, early seeding of safflower is strongly encouraged because the crop requires a long growing season of about 120 days to mature. If safflower is planted later than May 15, a yield reduction of 1.5 percent/day is calculated. A yield reduction of 99 percent is used for a safflower planting date later than June 1.

Yield Summary

The model prints a final yield prediction and a summary table of how each management decision affected yield (example, table 8). With this information, the user can change some management options before deciding whether to crop or fallow the field in question. Or, the user may wish to make an optional economic analysis before deciding to crop or fallow the field in question. The economic analysis considers some of the fixed and variable costs.

Economic Analysis

An optional economic section of the program computes and summarizes certain variable and fixed costs the user is asked to input. Statements are provided to help estimate costs where needed. The user inputs the ex-

Table 8.—Example of summary table showing how each management decision affected yield

CROP MANAGEMENT ANALYSIS		
S WHEAT	FOLLOWING S WHEAT	
FACTOR	YIELD	PERCENT
BASE YIELD	33	
ROTATION	31	-6
VARIETY	34	10
WEEDS	31	-9
FERTILITY	29	-6
DATE	29	0

THE PERCENT COLUMN GIVES THE AMOUNT OF INCREASE OR REDUCTION IN YIELD DUE TO MANAGEMENT DECISIONS.

pected sale price for the crop. Variable costs considered are:

1. Seeding rate and cost of seed.
2. Cost per pound of N and P.
3. Cost of grassy and broadleaf weed control, including chemical application costs.
4. Machinery variable costs, such as fuel, oil, and repairs.
5. Total hours of labor required for all operations and the labor cost per hour.

Fixed costs are taxes, insurance, machinery ownership, and return to management.

Totals for fixed and variable costs are listed in table form as well as expected gross income (example, table 9). The total of these fixed and variable costs is subtracted from gross return per unit area and listed as the return to the land investment. A list of references used to develop the economic help statements is given in Appendix C.

After completion of the economic analysis, the user knows the estimated yield level of the crop chosen and how each management decision affected that yield estimate together with the economic consequences of the management decisions made. This information makes a producer aware of the consequences of the cropping and soil management decisions made along the way and how each factor influences yield. At this point, the user has the option of changing to some other management option before finally deciding whether to recrop or fallow a given field.

Limitations

The program was designed to consider many of the production factors that affect crop yield. Estimates of yield potential are based on data the user supplies. Any deviations from normal precipitation patterns and alterations in crop management may cause higher or

Table 9.—Example of economic analysis table printed by the program showing several variable and fixed costs

ECONOMIC ANALYSIS	
S WHEAT	
FOLLOWING S WHEAT	
VARIABLE COSTS PER ACRE:	
SEED	3.60
NITROGEN	4.68
PHOSPHORUS	12.88
WEED CONTROL	5.00
MACHINERY	8.00
LABOR	4.00
TOTAL	38.16
FIXED COSTS PER ACRE (EXCEPT LAND):	
TAXES	3.50
INSURANCE	5.00
MACHINERY OWNERSHIP	20.00
RETURN TO MANAGEMENT	7.71
TOTAL	36.21
GROSS RETURN PER ACRE	110.20
RETURN OVER VARIABLE COSTS	72.04
RETURN OVER VARIABLE AND FIXED COSTS	35.83

lower grain yields than those estimated. The model does not account for unpredictable yield reductions caused by drought, disease, insects, hail, or wind. The main objectives are to make users aware of how their cropping and soil management decisions affect grain yield and to help them make a more intelligent decision on whether to recrop or fallow a given field, thus reducing the risk of an uneconomical return when using a flexible cropping system.

The model is currently being tested. Some preliminary results are shown in table 10, where actual farmer input has been used to estimate potential yield. For comparison, actual yields are also reported. Actual growing season data (precipitation, weed problems, and soil fertility) were input to calculate the postharvest yield potentials reported in table 10. Unfortunately, 1979 and 1980 were drought years in eastern Montana, which resulted in the poor agreement between the advanced predicted yield potentials and measured yields.

Table 10.—Examples of model predicted and measured rainfall and crop yield, and postharvest calculated yield for several eastern Montana crops and locations

Year	Location	Crop	Predicted		Measured		Calculated yield per acre ¹
			Rainfall	Yield per acre	Rainfall	Yield per acre	
1978	Dagmar	Spring wheat	(²)	(²)	9.0	39 bu	40 bu
	Glendive	----do----	(²)	(²)	6.0	20 bu	19 bu
1979	Sidney	----do----	7.7	57 bu	1.8	31 bu	30 bu
	--do--	----do----	5.9	48 bu	1.8	23 bu	21 bu
	--do--	Safflower	6.5	1,506 lb	1.8	1,207 lb	1,237 lb
	--do--	---do---	6.5	1,506 lb	1.8	854 lb	747 lb
1980 ³	--do--	Barley	7.0	47 bu	3.6	24 bu	10 bu
	--do--	---do---	7.0	30 bu	3.6	0 bu	0 bu

¹Model postharvest estimate of yield using actual growing season precipitation, fertility, and weed conditions.

²Not determined.

³Program printed warning indicating a high risk of crop failure due to inadequate stored soil water at seeding in 1980.

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Appendix A: BASIC Program Listing

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10 REM      VERSION 81-1 UPDATED 02/24/81 AT SIDNEY
11 REM      FOR PUBLICATION IN TECHNICAL BULLETIN AND TRANSMITTAL TO NDSU
12 REM      USE THIS VERSION AS BENCHMARK FOR USERS MANUAL
15 PRINT CHR$(12)
17 PRINT "*****"
20 PRINT "* FLEXCROP - A MANAGEMENT PROGRAM FOR DRYLAND "
25 PRINT "*      GRAIN AND SAFFLOWER.
30 PRINT "*      PROGRAM BY:
35 PRINT "*          ARDELL HALVORSON, USDA-SEA-AR, SIDNEY, MT
40 PRINT "*          PAUL KRESGE, MSU-EXTENSION SERVICE, BOZEMAN, MT
45 PRINT "*****"
50 PRINT
55 PRINT "Would you like to see a description of the program? YES or NO."
60 INPUT Q$
65 IF Q$="NO" THEN 125
70 IF Q$="YES"
THEN 80
75 GOTO 55
80 REM      PROGRAM DESCRIPTION
85 PRINT "The crop management program is based on the amount of water"
90 PRINT "available for crop growth. A base yield will be calculated"
95 PRINT "and then adjusted based on variety selection, fertilizer"
100 PRINT "applications, weed control, and planting date. At the"
105 PRINT "present time the program will operate for spring wheat,"
110 PRINT "winter wheat, barley, oats, and safflower on dryland."
125 REM      *****
130 REM      CROP SELECTION MODULE, SPRING GRAINS
135 REM      *****
155 PRINT
160 REM      ASK FOR PREVIOUS CROP
165 PRINT "Crop sequence is a very important consideration in"
170 PRINT "flexible cropping systems."
175 PRINT "Please indicate what crop was on the field the previous"
180 PRINT "year by typing S WHEAT, W WHEAT, BARLEY, OATS, SAFFLOWER,"
182 PRINT "FALLOW or OTHER."
185 INPUT L$
190 IF L$="HELP" THEN 655
195 IF L$="OTHER" THEN 240
200 IF L$="FALLOW" THEN 240
205 IF L$="S WHEAT" THEN 240
207 IF L$="W WHEAT" THEN 240
210 IF L$="BARLEY" THEN 240
215 IF L$="OATS" THEN 240
220 IF L$="SAFFLOWER" THEN 240
225 PRINT
230 PRINT "DON'T PANIC, JUST TRY AGAIN."
235 GOTO 175
240 REM      MAIN PART OF SUBROUTINE
245 PRINT
250 PRINT "Your management alternatives are S WHEAT, W WHEAT, BARLEY, OATS"
255 PRINT "SAFFLOWER, and FALLOW. Which crop will you plant?"
260 PRINT "Type STOP to terminate the program."
265 INPUT C$
270 PRINT
275 IF C$="HELP" THEN 695
280 IF C$="S WHEAT" THEN 370
282 IF C$="W WHEAT" THEN 370
285 IF C$="BARLEY" THEN 430
290 IF C$="OATS" THEN 480
295 IF C$="FALLOW" THEN 590
300 IF C$="SAFFLOWER" THEN 320
305 IF C$="STOP" THEN 915
310 PRINT "TILT !!!"
315 GOTO 240
320 REM      SAFFLOWER PORTION OF CROP SELECTION
325 IF L$<>"SAFFLOWER" THEN 910
330 GOTO 910
335 PRINT "Safflower following safflower is not recommended."
340 PRINT "Do you want to choose another crop? YES or NO."
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345 INPUT Q$
350 IF Q$="HELP" THEN 825
355 IF Q$="YES" THEN 240
360 GOTO 910
365 PRINT
370 REM      WHEAT PORTION OF CROP SELECT MODULE
375 REM      TEST BASED ON PREVIOUS CROP
380 IF L$="S WHEAT" AND C$="S WHEAT" THEN 390
382 IF C$="W WHEAT" AND L$="W WHEAT" THEN 390
384 IF C$="W WHEAT" THEN 905
385 GOTO 910
390 PRINT
395 REM      CHOOSE AGAIN BASED ON PREVIOUS CROP
400 PRINT "Following wheat with wheat will probably result in yield reduction."
405 PRINT "Do you want to choose another crop? YES or NO."
410 INPUT Q$
415 IF Q$="YES" THEN 240
420 IF Q$="HELP" THEN 720
422 IF Q$="NO" AND C$="S WHEAT" THEN 910
424 IF Q$="NO" AND C$="W WHEAT" THEN 905
426 GOTO 395
430 REM      BARLEY PORTION OF CROP SELECTION
435 IF L$="BARLEY" THEN 445
440 GOTO 910
445 PRINT
450 PRINT "Following barley with barley may result in a yield reduction."
455 PRINT "Do you want to choose another crop? YES or NO."
460 INPUT Q$
465 IF Q$="YES" THEN 240
470 IF Q$="HELP" THEN 755
475 GOTO 910
480 REM      OATS PORTION OF CROP SELECTION
485 REM      TEST FOR OATS FOLLOWING OATS
490 IF L$<>"OATS" THEN 535
495 PRINT
500 PRINT "Following oats with oats may result in yield reduction."
505 PRINT "Do you want to choose another crop? YES or NO."
510 INPUT Q$
515 IF Q$="YES" THEN 240
520 IF Q$="NO" THEN 535
525 IF Q$="HELP" THEN 790
530 GOTO 505
535 REM      TEST FOR OATS FOLLOWING SAFFLOWER
540 IF L$<>"SAFFLOWER" THEN 910
545 PRINT
550 PRINT "Planting oats following safflower may result in yield reduction."
555 PRINT "Do you want to choose another crop? YES or NO."
560 INPUT Q$
565 IF Q$="YES" THEN 240
570 IF Q$="NO" THEN 910
575 IF Q$="HELP" THEN 875
580 GOTO 555
585 REM      FALLOW PORTION OF CROP SELECT
590 IF L$="FALLOW" THEN 625
600 PRINT "Choosing fallow as an alternative terminates the program."
605 PRINT "Do you want to try a crop anyway? YES or NO."
610 INPUT Q$
615 IF Q$="YES" THEN 240
620 GOTO 915
625 PRINT
630 PRINT "Following two years in a row is unacceptable, PICK A CROP."
635 GOTO 240
640 PRINT "You have enough water to recrop."
645 GOTO 600
650 REM      HELP MESSAGES FOR CROP SELECTION
655 REM      HELP FOR PREVIOUS CROP
660 PRINT
665 PRINT "The answer to this question distinguishes between fallow and"
670 PRINT "recrop situations. This information affects fertilizer recom-"

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675 PRINT "mendations and the economic analysis. If a crop other than"
680 PRINT "those listed was on the field the previous year, type OTHER."
685 PRINT
690 GOTO 175
695 REM      HELP FOR CROP SELECTION
700 PRINT
705 PRINT "This program only operates for spring grain and safflower."
710 PRINT "Choosing fallow will terminate the program."
715 GOTO 240
720 REM      HELP FOR ROTATION, WHEAT
725 PRINT
730 PRINT "Research has shown that cropping with spring wheat two years in a"
735 PRINT "row results in an average yield reduction of 5%. If you type NO,"
740 PRINT "the program will go ahead with wheat. If you type YES, you will be"
745 PRINT "able to choose another crop."
750 GOTO 405
755 REM      HELP FOR ROTATION, BARLEY
760 PRINT
765 PRINT "Research has shown that cropping with barley two years in a"
770 PRINT "row results in an average yield reduction of 2%. If you type NO,"
775 PRINT "the program will go ahead with barley. If you type YES, you will"
780 PRINT "be able to choose another crop."
785 GOTO 445
790 REM      HELP FOR ROTATION, OATS
795 PRINT
800 PRINT "Research has shown that cropping with oats two years in a"
805 PRINT "row results in an average yield reduction of 10%. If you type NO,"
810 PRINT "the program will go ahead with oats. If you type YES, you will"
815 PRINT "be able to choose another crop."
820 GOTO 515
825 REM      HELP FOR ROTATION, SAFFLOWER
830 PRINT
835 PRINT "Research indicates that an 80% reduction may be expected"
840 PRINT "for safflower planted following safflower."
845 REM      HELP FOR FALLOW AS CROP CHOICE
850 PRINT
855 PRINT "We can't deal with grain yields for fallow land, can we?"
860 PRINT "Enter YES to try a crop in spite of low available water or NO"
865 PRINT "to terminate the program."
870 GOTO 605
875 REM      HELP FOR OATS FOLLOWING SAFFLOWER
880 PRINT
885 PRINT "Oats are very sensitive to residue of treflan used for weed control"
890 PRINT "in safflower. Yields will be severely reduced. Enter YES"
895 PRINT "to choose a different crop."
900 GOTO 550
905 CHAIN "MOD8",1000,ALL
910 CHAIN "MOD2",900,ALL
915 END

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10 CHAIN "FLEXCROP",15
800 REM      MODULE 2
900 REM
905 DIM P(12)
910 REM      ****
915 REM      SEEDING DATE SUBROUTINE FOR SMALL GRAIN
920 REM      ****
925 PRINT
930 PRINT "Enter the MONTH and DAY you plan to seed the crop."
935 PRINT "For HELP type 0,0"
940 PRINT "Example: 4,20"
945 INPUT Z1,Z2
950 IF Z1=0 THEN 1040
955 IF Z1<4 THEN 980
960 IF Z1>6 THEN 980
965 IF Z2>31 THEN 980
970 Z5=0
975 GOTO 990
980 PRINT "Please enter only 4, 5, or 6 for month and 1 to 31 for day."
985 GOTO 930
990 REM  CALCULATE DAY OF YEAR
995 IF Z1=4 THEN 1010
1000 IF Z1=5 THEN 1020
1005 IF Z1=6 THEN 1030
1010 Z3=Z2+90
1015 GOTO 1035
1020 Z3=Z2+120
1025 GOTO 1035
1030 Z3=Z2+151
1035 GOTO 1140
1040 REM      HELP FOR SEEDING DATE
1045 IF C$="SAFFLOWER" THEN 1115
1050 PRINT
1055 PRINT "Delayed seeding of spring grains will result in reduced yields."
1060 PRINT "If the seeding date is later than the recommended date for the"
1065 PRINT "cropping district, a yield reduction is calculated. Recommended"
1070 PRINT "seeding dates are no later than April 20 in Central Montana"
1075 PRINT "(Districts 2, 4, and 5) and May 15 in Eastern Montana (Districts"
1080 PRINT "3 and 6). The yield reduction for each day of delay in seeding"
1085 PRINT "depends upon the fertility level of the soil. A reduction of 0.4"
1090 PRINT "bu/day can be expected at high fertility, 0.21 bu/day at medium"
1095 PRINT "fertility and 0.16 bu/day at low fertility. Enter only 4,"
1100 PRINT "5, or 6 for month and 1 to 31 for day in this order: MONTH,"
1105 PRINT "then DAY."
1110 GOTO 1135
1115 PRINT
1120 PRINT "Seeding safflower after May 15 will result in a yield reduction of"
1125 PRINT "1.5% per day. Seeding after June 15 will result in a 99% total"
1130 PRINT "yield reduction."
1135 GOTO 925
1140 REM      ****
1145 REM      SOIL WATER MODULE
1150 REM      ****
1155 PRINT
1160 PRINT "Soil water is the factor which will determine crop growth"
1165 PRINT "and management. What is the MOIST SOIL DEPTH IN FEET?"
1170 INPUT Q$
1175 IF Q$="HELP" THEN 1690
1180 M=VAL(Q$)
1185 IF M<4 THEN 1195
1190 M=4
1195 PRINT
1200 REM      INPUT TEXTURE
1205 PRINT "Is your soil texture coarse, moderately coarse or medium-fine?"
1210 PRINT "Input CO, MC, MF, or HELP."
1215 INPUT T$
1220 IF T$="MF" THEN 1245
1225 REM      GET TEXTURE CONVERSION FACTOR
1230 IF T$="MC" THEN 1255

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1235 IF T$="CO" THEN 1265
1240 IF T$="HELP" THEN 1525
1245 T=2
1250 GOTO 1275
1255 T=1.5
1260 GOTO 1275
1265 T=.8
1270 GOTO 1275
1275 S=M*T
1280 PRINT
1285 PRINT
1290 PRINT "Available soil water is";S;"inches."
1295 PRINT
1300 REM      EXPECTED GROWING SEASON PRECIP FOR DRYLAND SPRING GRAIN
1305 REM      INPUT LOCATION
1310 PRINT 'Type the name of the nearest location with weather records.'
1315 PRINT 'Input LOCATION NAME, NONE, or HELP for a list of locations.'
1320 PRINT 'Type multiple word names without spaces.'
1325 INPUT B$
1330 IF B$="HELP" THEN 2270
1335 IF B$="NONE" THEN 1345
1340 GOTO 1405
1345 PRINT
1350 PRINT 'What is your GROWING SEASON PRECIPITATION in INCHES?'
1355 INPUT Q$
1360 IF Q$="HELP" THEN 1590
1365 P=VAL(Q$)
1370 IF P>20 THEN 1590
1375 PRINT
1380 PRINT 'Which CROPPING DISTRICT are you in?'
1385 INPUT Q$
1390 IF Q$="HELP" THEN 1615
1395 X3=VAL(Q$)
1400 GOTO 1490
1405 OPEN "I",#1,"PRECIP"
1415 INPUT #1,X1,X3,X$
1417 IF X$="END" THEN 2260
1420 FOR N=1 TO 12
1425 INPUT #1,P(N)
1430 NEXT N
1435 IF X$=B$ THEN 1441
1440 GOTO 1415
1441 CLOSE #1
1442 IF M<3 THEN 1450
1444 IF Z3<120 THEN 1448
1446 P=((151-(Z3+10))/31)*P(5)+P(6)+P(7)
1447 GOTO 1490
1448 P=((120-(Z3+10))/30)*P(4)+P(5)+P(6)+P(7)
1449 GOTO 1490
1450 PRINT 'How many days after April 1 was soil water measured?'
1452 INPUT Q$
1454 IF Q$="HELP" THEN 1730
1455 PRINT
1456 D1=VAL(Q$)
1457 D1=D1+90
1458 IF D1>150 THEN 1730
1460 IF D1<120 THEN 1464
1462 P=((151-D1)/31)*P(5)+P(6)+P(7)
1463 GOTO 1490
1464 P=((120-D1)/30)*P(4)+P(5)+P(6)+P(7)
1490 REM      CALCULATE TOTAL CROP WATER
1495 W=S+P
1500 PRINT
1505 PRINT 'The estimated water available for crop production is';W;
1510 PRINT 'inches, including growing season precipitation.'
1515 CHAIN 'MOD3',1500,ALL
1520 REM      HELP MESSAGE SECTION FOR SOIL WATER MODULE
1525 REM      HELP FOR SOIL TEXTURE
1530 PRINT

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1535 PRINT "The soil texture categories are:"
1540 PRINT "COARSE (CO)"TAB(20)"fine sand (FS), loamy sand (LS)"
1550 PRINT "MOD. COARSE (MC)"TAB(20)"sandy loam (SL), fine sandy loam (FSL)"
1560 PRINT "MEDIUM-FINE (MF)"TAB(20)"loam (L), silt loam (SiL), clay loam (CL)"
1570 PRINT TAB(20)"silty clay loam (SiCL), silty clay (SiC)"
1575 PRINT TAB(20)"clay (C)"
1580 PRINT
1585 GOTO 1205
1590 REM      HELP FOR GROWING SEASON PRECIP
1595 PRINT
1600 PRINT "Enter the inches of precipitation you expect to receive between"
1605 PRINT "April 1 and July 31. An average value is 6 inches."
1610 GOTO 1345
1615 REM      HELP FOR CROPPING DISTRICT
1620 PRINT
1625 PRINT "The cropping district numbers are:"
1630 PRINT TAB(5)"1. Northwest Montana"TAB(30)"4. Central Montana"
1635 PRINT TAB(5)"2. Southwest Montana"TAB(30)"5. Northcentral Montana"
1640 PRINT TAB(5)"3. Southeast Montana"TAB(30)"6. Northeast Montana"
1645 GOTO 1375
1650 REM      HELP FOR MOIST SOIL DEPTH
1655 PRINT
1660 PRINT "Moist soil depth provides a measure of the amount of stored soil"
1665 PRINT "water. For spring crops, soil moisture should be measured prior"
1670 PRINT "to planting to make cropping decisions, seeding rates and"
1675 PRINT "fertilizer rates more accurate. Moist soil depth can be measured"
1680 PRINT "most easily with a soil moisture probe."
1685 GOTO 1155
1690 REM      HELP FOR MSD DATE
1695 PRINT
1700 PRINT "Montana State University recommends measuring soil water (moist"
1705 PRINT "soil depth) around April 15 of the crop year."
1710 PRINT
1715 GOTO 1450
1720 CLOSE#1
1725 REM      LOCATION HELP
1730 PRINT
1735 PRINT
1740 PRINT "Weather records are available for 130 locations in Montana."
1745 PRINT "Choose the location which most closely represents your situation."
1750 PRINT
1755 GOTO 1450
1760 INPUT Q$
1765 IF Q$="GO" THEN 1315
1770 IF Q$="LIST" THEN 2360
1775 GOTO 2310
1780 PRINT
1785 PRINT "Weather records are available for the following locations:"
1790 PRINT "(Cropping districts are in parenthesis)"
1795 PRINT
1800 PRINT TAB(5)"ANACONDA (2)"TAB(25)"FORTINE (1)"TAB(45)"PHILLIPSBURG (2)"
1805 PRINT TAB(5)"AUGUSTA (2)"TAB(25)"FORT PECK (6)"TAB(45)"PLEASANT VALLEY (1)"
1810 PRINT TAB(5)"BABE (5)"TAB(25)"FRAZER (6)"TAB(45)"PELVNA (6)"
1815 PRINT TAB(5)"BAKER (3)"TAB(25)"GIBSON (2)"TAB(45)"POLSON (1)"
1820 PRINT TAB(5)"BALLANTINE (3)"TAB(25)"GLASGOW (6)"TAB(45)"POPLAR (6)"
1825 PRINT TAB(5)"BARBER (4)"TAB(25)"GLENDIVE (6)"TAB(45)"RAFELJE (3)"
1830 PRINT TAB(5)"BELGRADE (2)"TAB(25)"GOLDBUTTE (5)"TAB(45)"REO LODGE (3)"
1835 PRINT TAB(5)"BIG SANDY (5)"TAB(25)"GRASSRANGE (4)"TAB(45)"ROCK SPRINGS (3)"
1840 PRINT TAB(5)"BIG TIMBER (3)"TAB(25)"GREAT FALLS (4)"TAB(45)"ROUNDUP (4)"
1845 PRINT TAB(5)"BILLINGS (3)"TAB(25)"HAMILTON (1)"TAB(45)"ROY (4)"
1850 PRINT TAB(5)"BOULDER (2)"TAB(25)"HARDIN (3)"TAB(45)"SAVAGE (6)"
1855 PRINT TAB(5)"BOZEMAN (2)"TAB(25)"HARLOWTON (4)"TAB(45)"SCOBAY (6)"
1860 PRINT TAB(5)"BRAIDY AZNOE (5)"TAB(25)"HAUGAN (1)"TAB(45)"SEELEY LAKE (1)"
1865 PRINT TAB(5)"BRIDGER (3)"TAB(25)"HAVRE (5)"TAB(45)"SIDNEY (6)"
1870 PRINT TAB(5)"BROWNING (5)"TAB(25)"HEBGEN DAM (2)"TAB(45)"SIMPSON (5)"
1875 PRINT TAB(5)"BRUSETT (6)"TAB(25)"HELENA (2)"TAB(45)"STEVENSVILLE (1)"
1880 PRINT TAB(5)"BUSBY (3)"TAB(25)"HERON (1)"TAB(45)"STANFORD (4)"
1885 PRINT TAB(5)"BUTTE (2)"TAB(25)"HOLTER DAM (2)"TAB(45)"ST IGNATIUS (1)"

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2580 PRINT TAB(5)"CASCADE (4)"TAB(25)"HUNTLEY (3)"TAB(45)"SUMMIT (1)"  
2590 PRINT TAB(5)"CHINOOK (5)"TAB(25)"JOPLIN (5)"TAB(45)"SUN RIVER (4)"  
2600 PRINT TAB(5)"CHOTEAU (5)"TAB(25)"JORDAN (6)"TAB(45)"SUPERIOR (1)"  
2610 INPUT "Enter RETURN to continue.";Q$  
2620 PRINT TAB(5)"CIRCLE (6)"TAB(25)"KALISPELL (1)"TAB(45)"TELEGRAPH CREEK (5)"  
2630 PRINT TAB(5)"COLSTRIP (3)"TAB(25)"LAKEVIEW (2)"TAB(45)"THOMPSON FALLS (1)"  
2640 PRINT TAB(5)"COLUMBUS (3)"TAB(25)"LAME DEER (3)"TAB(45)"TOWNSEND (2)"  
2650 PRINT TAB(5)"CONRAD (5)"TAB(25)"LEWISTOWN (4)"TAB(45)"TRIDENT (2)"  
2660 PRINT TAB(5)"COOKE CITY (2)"TAB(25)"LIBBY (1)"TAB(45)"TROUT CREEK (1)"  
2670 PRINT TAB(5)"CROW AGENCY (3)"TAB(25)"LIMA (2)"TAB(45)"TROY (1)"  
2680 PRINT TAB(5)"CULBERTSON (6)"TAB(25)"LIVINGSTON (2)"TAB(45)"TURNER (5)"  
2690 PRINT TAB(5)"CUT BANK (5)"TAB(25)"LONEPINE (1)"TAB(45)"VALIER (5)"  
2700 PRINT TAB(5)"DARBY (1)"TAB(25)"LOWETH (4)"TAB(45)"VIDA (6)"  
2710 PRINT TAB(5)"DEER LODGE (2)"TAB(25)"LUSTRE (6)"TAB(45)"VIRGINIA CITY (2)"  
2720 PRINT TAB(5)"DENTON (4)"TAB(25)"MALTA (5)"TAB(45)"WESTBY (6)"  
2730 PRINT TAB(5)"DILLON (2)"TAB(25)"MEDICINE LAKE (6)"TAB(45)"WEST GLACIER (1)"  
2740 PRINT TAB(5)"DUNKIRK (5)"TAB(25)"MELSTONE (4)"TAB(45)"WEST YELLOWSTONE (2)"  
2750 PRINT TAB(5)"EAST ANACONDA (2)"TAB(25)"MILDRED (6)"TAB(45)"WHITEFISH (1)"  
2760 PRINT TAB(5)"EKALAKA (3)"TAB(25)"MILES CITY (3)"  
2770 PRINT TAB(45)"WHITE SULPHUR SPRINGS (2)"  
2780 PRINT TAB(5)"ENNIS (2)"TAB(25)"MISSOULA (1)"TAB(45)"WIBAUX (6)"  
2790 PRINT TAB(5)"FAIRFIELD (5)"TAB(25)"MISSOULA WEST (1)"TAB(45)"WINIFRED (4)"  
2800 PRINT TAB(5)"FLAXVILLE (4)"TAB(25)"MOCCASIN (4)"TAB(45)"WINNETT (4)"  
2810 PRINT TAB(5)"FORKS (5)"TAB(25)"MYSTIC LAKE (3)"TAB(45)"WISDOM (2)"  
2820 PRINT TAB(5)"FORSYTH (3)"TAB(25)"NORRIS (2)"TAB(45)"WOLF POINT (6)"  
2830 PRINT TAB(5)"FORT ASSINIBOINE(5)"TAB(25)"OVANDO (2)"TAB(45)"WYOLA (3)"  
2840 PRINT TAB(5)"FORT BENTON (5)"TAB(25)"PENDROY (5)"  
2860 GOTO 1315
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10 CHAIN "FLEXCROP",15
1500 REM MODULE 3 FOR FLEXCROP
1520 DIM K(35)
1530 FOR N=1 TO 35
1540 READ K(N)
1550 NEXT N
1600 GOTO 2115
1610 DATA 1:026,0:946,1:019,1:117,1:137,1:119,1:088,1:089
1620 DATA 1:047,1:094,1:011,1:170,1:130,1:124,1:088,1:081
1630 DATA 1.000,1.146,0.892,1.031,1.095,0.953,1.040
1640 DATA 1.026,1.049,1.093,1.066,1.073,1.075
1650 DATA 1.047,1.169,1.000,1.081,1.124,1.043
2000 REM ****
2005 REM SUBROUTINE FOR CHANGING CROP DUE TO WATER
2010 REM ****
2015 PRINT "Low stored soil water indicates a high risk of crop failure."
2020 PRINT "Would you like to make another choice? YES or NO."
2025 INPUT Q$
2030 IF Q$="YES" THEN 2050
2035 IF Q$="HELP" THEN 2065
2040 IF Q$="NO" THEN 2055
2045 GOTO 2020
2050 CHAIN "FLEXCROP",240
2055 REM GOES BACK TO CROP IN SPITE OF LOW WATER
2060 RETURN
2065 REM HELP FOR LOW STORED SOIL WATER
2070 PRINT
2075 PRINT "A minimum of 3 inches of stored water is recommended for wheat"
2080 PRINT "and barley. You only have ";S;" inches. Type NO if you want to go"
2085 PRINT "ahead anyway. If not you might type YES and then try oats which"
2090 PRINT "should do better."
2095 IF L$="FALLOW" THEN 2110
2100 PRINT "In a flexible cropping system, fallowing in a dry year might be"
2105 PRINT "the best choice."
2110 GOTO 2020
2115 REM ****
2120 REM BRANCH TO SPRING GRAIN
2125 REM ****
2130 IF C$="S WHEAT" THEN 2150
2135 IF C$="BARLEY" THEN 2425
2140 IF C$="OATS" THEN 2685
2145 IF C$<>"SAFFLOWER" THEN PRINT "CROP ERROR"
2147 CHAIN "MOD4",3025,ALL
2150 REM ****
2155 REM WHEAT YIELD MODULE
2160 REM ****
2165 IF S>3 THEN 2175
2170 GOSUB 2005
2175 Y=INT((W*6.05)-32)
2180 REM CALCULATE BASE YIELD (THATCHER, FALLOW)
2185 IF L$="FALLOW" THEN 2195
2190 Y=INT(Y-(-.1*Y+9))
2195 PRINT
2200 IF Y<=0 THEN 3000
2205 PRINT "YOUR BASE YIELD IS ";Y;" BUSHELS PER ACRE"
2210 IF L$<>"S WHEAT" THEN 2225
2215 Y7=INT(Y*.95)
2220 GOTO 2235
2225 Y7=Y
2230 GOTO 2250
2235 PRINT
2240 PRINT "FOLLOWING WHEAT WITH WHEAT REDUCED THE BASE YIELD FROM ";Y
2245 PRINT "TO ";Y7;" BUSHELS PER ACRE."
2250 REM SELECT VARIETY
2255 PRINT "The recommended varieties for your area are:"
2260 IF X3=1 THEN 2305
2265 IF X3=2 THEN 2305
2270 IF X3=3 THEN 2305
2275 IF X3=4 THEN 2295

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2280 IF X3=5 THEN 2285
2285 PRINT"2. LEW* 4. NEWANA 6. OLAF 7. THATCHER 8. TIOGA*"
2290 GOTO 2310
2295 PRINT"1. FORTUNA* 4. NEWANA 5. NORANA 6. OLAF 7. THATCHER"
2300 GOTO 2310
2305 PRINT"1. FORTUNA 4. NEWANA 5. NORANA 7. THATCHER"
2310 PRINT"20. OTHER" *DENOTES SAWFLY RESISTANCE*
2315 PRINT
2320 PRINT "Type the NUMBER of the variety you want to plant."
2325 INPUT Q$
2330 IF Q$="HELP" THEN 2940
2335 J=VAL(Q$)
2340 IF J=20 THEN 2350
2345 GOTO 2355
2350 J=9
2355 IF L$="FALLOW" THEN 2370
2360 Y2=INT(Y7*K(J))
2365 GOTO 2385
2370 J=J+10
2375 Y2=INT(Y7*K(J))
2380 GOTO 2385
2385 PRINT
2390 PRINT"YOUR YIELD IS NOW";Y2;"BUSHELS PER ACRE"
2395 V=2
2400 CHAIN "MOD5A",3630,ALL
2425 REM ****
2430 REM BARLEY YIELD MODULE
2435 REM ****
2440 IF S>3 THEN 2450
2445 GOSUB 2005
2450 Y=INT((W*9.32)-42.6)
2455 IF L$="FALLOW" THEN 2465
2460 Y=INT(Y-(-.1*Y+9))
2465 PRINT
2470 IF Y<=0 THEN 3000
2475 PRINT "YOUR BASE YIELD IS ";Y;" BUSHELS PER ACRE."
2480 IF L$<>"BARLEY" THEN 2495
2485 Y7=INT(Y*.98)
2490 GOTO 2505
2495 Y7=Y
2500 GOTO 2520
2505 PRINT
2510 PRINT "FOLLOWING BARLEY WITH BARLEY REDUCED YIELD FROM ";Y;" TO"
2515 PRINT Y7;" BUSHELS PER ACRE."
2520 PRINT "The recommended varieties for your area are:"
2525 IF X3=1 THEN 2585
2530 IF X3=2 THEN 2555
2535 IF X3=3 THEN 2570
2540 IF X3=4 THEN 2555
2545 IF X3=5 THEN 2555
2550 IF X3=6 THEN 2555
2555 PRINT "1. COMPANA 2. DEKAP 3. ERBET 4. GEORGIE 5. HECTOR"
2560 PRINT "6. HORSFORD* 7. PIROLINE"
2565 GOTO 2590
2570 PRINT "1. COMPANA 2. DEKAP 3. ERBET 4. GEORGIE 5. HECTOR"
2575 PRINT "7. PIROLINE"
2580 GOTO 2590
2585 PRINT "3. ERBET 4. GEORGIE 6. HORSFORD*"
2590 PRINT "9. SHABET 10. STEPTOE 11. SUMMIT 12.UNITAN 13. VIREO"
2595 PRINT "20. OTHER"
2600 PRINT
2605 PRINT "Type the NUMBER of the variety you want to plant."
2610 INPUT J$
2615 IF J$="HELP" THEN 2940
2617 J=VAL(J$)
2620 IF J<20 THEN 2630
2625 J=17
2627 GOTO 2635
2630 J=J+16

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2635 Y2=INT(Y7*K(J))
2640 PRINT
2645 PRINT "YOUR YIELD IS NOW";Y2;"BUSHELS PER ACRE."
2650 REM WEED AND FERTILITY SUBROUTINE
2655 V=1.6
2660 CHAIN "MOD5A",3630,ALL
2685 REM ****
2690 REM DAT YIELD MODULE
2695 REM ****
2700 IF S>1 THEN 2710
2705 GOSUB 2005
2710 Y=INT((W*13.67)-73.6)
2715 IF L$="FALLOW" THEN 2725
2720 Y=INT(Y-(-.1*Y+9))
2725 PRINT
2730 IF Y<=0 THEN 3000
2735 PRINT "YOUR BASE YIELD IS";Y;"BUSHELS PER ACRE"
2740 IF L$<>"OATS" THEN 2755
2745 Y7=INT(Y*.9)
2750 GOTO 2765
2755 Y7=Y
2760 GOTO 2780
2765 PRINT
2770 PRINT "FOLLOWING OATS WITH OATS REDUCED YIELD FROM ";Y;" TO ";Y7
2775 PRINT "BUSHELS PER ACRE."
2780 REM SELECT VARIETY
2785 PRINT "The recommended varieties for your area are"
2790 IF X3=1 THEN 2845
2795 IF X3=2 THEN 2845
2800 IF X3=3 THEN 2835
2805 IF X3=4 THEN 2835
2810 IF X3=5 THEN 2835
2815 IF X3=6 THEN 2825
2820 GOTO 2785
2825 PRINT "1. BASIN 2. CAYUSE 3. GOPHER 4. KELSEY 5. OTANA"
2830 GOTO 2850
2835 PRINT "1. BASIN 2. CAYUSE 3. GOPHER 5. OTANA 6. PARK"
2840 GOTO 2850
2845 PRINT "1. BASIN 2 CAYUSE 3. GOPHER 5. OTANA"
2850 PRINT "20. OTHER"
2855 PRINT "Type the NUMBER of the variety you want to plant."
2860 INPUT J$
2865 IF J$="HELP" THEN 2940
2867 J=VAL(J$)
2870 IF J<20 THEN 2880
2875 J=32
2877 GOTO 2885
2880 J=J+29
2885 Y2=INT(Y7*K(J))
2890 PRINT
2895 PRINT "YOUR YIELD IS NOW";Y2;"BUSHELS PER ACRE."
2900 REM WEED AND FERTILITY SUBROUTINES
2905 V=1.1
2910 A$="NO"
2915 Y3=Y2
2920 CHAIN "MOD5A",3825,ALL
2940 REM HELP FOR VARIETY SELECTION
2945 PRINT
2950 PRINT "Varieties vary in their yielding ability. The relative yield of"
2955 PRINT "each variety was calculated using the following as check varieties:"
2960 PRINT TAB(10)"SPRING WHEAT";TAB(30)"THATCHER"
2965 PRINT TAB(10)"BARLEY";TAB(30)"COMPANA"
2970 PRINT TAB(10)"OATS";TAB(30)"GOPHER"
2975 PRINT "If the variety you want to grow is not listed, enter 20 for other."
2980 PRINT "This will result in the same yield as for the check variety."
2985 IF C$="S WHEAT" THEN 2320
2990 IF C$="BARLEY" THEN 2600
2995 IF C$="OATS" THEN 2855
3000 REM THIS GOODIE PREVENTS NEGATIVE YIELDS
3005 PRINT
3010 PRINT "YOUR YIELD IS ZERO BUSHELS PER ACRE DUE TO VERY LOW"
3015 PRINT "AVAILABLE WATER. YOU WILL HAVE TO START THE PROGRAM OVER."
3020 CHAIN "MOD7",9215,ALL

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10 CHAIN "FLEXCROP",15
3025 REM ****
3030 REM SAFFLOWER MODULE (No. 4)
3035 REM ****
3040 IF S>2 THEN 3050
3045 GOSUB 3700
3050 PRINT
3055 V=.05
3060 PRINT "Safflower has only been grown successfully in the Northeastern, "
3065 PRINT "Eastern Triangle, and Yellowstone Valley areas of Montana."
3070 PRINT "Do you wish to select another crop? YES or NO."
3075 INPUT Q$
3080 IF Q$="HELP" THEN 3485
3085 IF Q$="YES" THEN 3100
3090 IF Q$="NO" THEN 3105
3095 GOTO 3070
3100 CHAIN "FLEXCROP",240
3105 IF L$="FALLOW" THEN 3140
3110 Y=1506
3115 IF S<6 THEN 3125
3120 GOTO 3145
3125 R=.1335*S+.221
3130 Y=INT(Y*R)
3135 GOTO 3145
3140 Y=2000
3145 PRINT "YOUR BASE YIELD IS";Y;"POUNDS PER ACRE."
3150 IF L$="FALLOW" THEN 3205
3155 REM ROTATION
3157 IF L$="SAFFLOWER" THEN 3195
3160 IF L$<>"OTHER" THEN 3205
3165 PRINT "Planting safflower on a given field following mustard, sunflowers,"
3170 PRINT "is not recommended. Were any of these crops"
3175 PRINT "grown on the field the previous year? YES or NO."
3180 INPUT Q$
3185 IF Q$="NO" THEN 3205
3190 IF Q$<>"YES" THEN 3165
3195 Y7=Y*.5
3200 GOTO 3210
3205 Y7=Y
3210 PRINT
3215 PRINT "THE RECOMMENDED SAFFLOWER VARIETIES ARE:"
3220 PRINT TAB(10)'1. SIDWILL'
3225 PRINT TAB(10)'2. S208'
3230 PRINT TAB(10)'3. OTHER'
3235 PRINT "NOTE: Sidwill is the only variety recommended for use on"
3240 PRINT "summerfallow due to its Alternaria resistance."
3245 PRINT "Enter the NUMBER of your selection."
3250 INPUT Q$
3255 IF Q$="HELP" THEN 3530
3260 IF Q$="1" THEN 3290
3265 IF Q$="2" THEN 3285
3270 IF Q$<>"3" THEN 3215
3275 Y2=Y7*.8
3280 GOTO 3305
3285 IF L$="FALLOW" THEN 3300
3290 Y2=Y7
3295 GOTO 3305
3300 Y2=Y7*.8
3305 REM WEED MODULE
3310 J$="NO"
3315 PRINT "Describe your grassy weed problem as HEAVY, MEDIUM, LOW, or NONE."
3320 INPUT Q$
3325 IF Q$="HELP" THEN 3560
3330 IF Q$="HEAVY" THEN 3365
3335 IF Q$="MEDIUM" THEN 3375
3340 IF Q$="LOW" THEN 3385
3345 IF Q$<>"NONE" THEN 3315
3350 Y4=Y2
3355 A$="NO"

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3360 GOTO 3420
3365 Y4=Y2*.5
3370 GOTO 3390
3375 Y4=Y2*.75
3380 GOTO 3390
3385 Y4=Y2*.9
3390 PRINT "Will you use herbicides to control grassy weeds? YES or NO."
3395 INPUT A$
3400 IF A$="HELP" THEN 3605
3405 IF A$="NO" THEN 3420
3410 IF A$<>"YES" THEN 3390
3415 Y4=Y2
3420 REM      BRANCH TO SOIL FERTILITY
3425 CHAIN "MOD6",5845,ALL
3485 REM      HELP FOR GROWING AREA
3490 PRINT
3495 PRINT "If you are located outside of these areas, please contact your"
3500 PRINT "County Extension Office for details. Enter NO if you want to try"
3502 PRINT "safflower."
3505 GOTO 3060
3510 REM      HELP FOR SAFFLOWER ROTATION
3515 PRINT
3520 PRINT "Enter YES or NO depending on your situation."
3525 GOTO 3165
3530 REM      HELP FOR SAFFLOWER VARIETY
3535 PRINT
3540 PRINT "If you select a variety other than Sidwill or S208, your yield"
3545 PRINT "will be reduced by 20% since we do not have research data on other"
3550 PRINT "varieties. Enter 1 for Sidwill, 2 for S208, or 3 for any"
3552 PRINT "other variety."
3555 GOTO 3245
3560 REM      HELP FOR SAFFLOWER WEEDS
3565 PRINT
3570 PRINT "Grassy weeds include wild oats, Pigeongrass, cheatgrass, and"
3575 PRINT "volunteer small grain. Infestation levels would have the following"
3580 PRINT "ratings."
3585 PRINT TAB(5)"HEAVY"TAB(15)"In excess of 83 plants/sq. yd."
3590 PRINT TAB(5)"MEDIUM"TAB(15)"42 to 83 plants/sq.yd."
3595 PRINT TAB(5)"LOW"TAB(15)"Less than 42 plants/sq. yd."
3600 GOTO 3315
3605 REM      HELP FOR SAFFLOWER WEED CONTROL
3610 PRINT
3615 PRINT "Failure to control grassy weeds will result in yield reductions of"
3620 PRINT "50% for heavy, 25% for medium, and 10% for low grassy weed"
3625 PRINT "populations."
3630 GOTO 3390
3700 REM      LOW WATER SUBROUTINE
3705 PRINT
3710 PRINT "Low stored soil water indicates a high risk of crop failure."
3715 PRINT "Would you like to make another choice? YES or NO."
3720 INPUT Q$
3725 IF Q$="YES"THEN CHAIN "FLEXCROP", 240
3730 IF Q$="HELP" THEN 3745
3735 IF Q$="NO" THEN RETURN
3740 GOTO 3705
3742 RETURN
3745 REM      HELP FOR LOW WATER
3750 PRINT
3755 PRINT "A minimum of 2 inches of stored soil water is recommended for"
3760 PRINT "establishing safflower. You only have ";S;" inches."
3765 PRINT "Enter YES to go ahead with safflower or NO to choose another crop."
3795 PRINT
3800 GOTO 3715

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10 CHAIN "FLEXCROP",15
3630 REM ****
3635 REM      WEED SUBROUTINE FOR SMALL GRAINS
3640 REM ****
3645 PRINT
3650 PRINT "Describe your wild oat infestation as HIGH, MEDIUM, LOW, or NONE."
3655 INPUT Q$
3660 IF Q$="NONE" THEN 3800
3665 IF Q$="HELP" THEN 4115
3670 PRINT
3675 PRINT
3680 PRINT "Enter your wild oat control measure."
3685 PRINT "Enter NONE, FARGO, CARBYNE, AVENGE, HOELON, or HELP."
3690 INPUT A$
3695 IF A$="NONE" THEN 3730
3700 IF A$="HELP" THEN 4295
3705 IF A$="FARGO" THEN 4410
3710 IF A$="CARBYNE" THEN 4830
3715 IF A$="AVENGE" THEN 5105
3720 IF A$="HOELON" THEN 5515
3725 GOTO 3685
3730 IF C$="S WHEAT" THEN 3745
3732 IF C$="W WHEAT" THEN 3745
3735 V5=.023
3740 GOTO 3750
3745 V5=.0339
3750 IF Q$="HIGH" THEN 3770
3755 IF Q$="MEDIUM" THEN 3780
3760 IF Q$="LOW" THEN 3790
3765 GOTO 3645
3770 Y3=Y2-INT(Y2*V5*SQR(100))
3775 GOTO 3815
3780 Y3=Y2-INT(Y2*V5*SQR(50))
3785 GOTO 3815
3790 Y3=Y2-INT(Y2*V5*SQR(10))
3795 GOTO 3815
3800 A$="NONE"
3805 Y3=Y2
3810 IF Y3=Y2 THEN 3825
3815 PRINT
3820 PRINT "YOUR YIELD IS REDUCED FROM";Y2;"TO";Y3"BUSHELS PER ACRE."
3825 PRINT
3830 PRINT "Do you have green foxtail problems? Enter YES or NO."
3835 INPUT Q$
3840 IF Q$="YES" THEN 3855
3845 IF Q$="HELP" THEN 4200
3850 GOTO 3875
3855 PRINT
3860 PRINT "Green foxtail problems can be reduced by early seeding"
3865 PRINT "and narrow row spacing."
3870 REM      BROADLEAF WEED SECTION
3875 PRINT
3880 PRINT "If broadleaf weeds are a problem, what level of infestation do"
3885 PRINT "You have. Enter HIGH, MEDIUM, LOW, or NONE."
3890 INPUT B$
3895 IF B$="NONE" THEN 3985
3900 IF B$="HELP" THEN 4225
3905 IF B$="HIGH" THEN 3925
3910 IF B$="MEDIUM" THEN 3935
3915 IF B$="LOW" THEN 3945
3920 GOTO 3875
3925 Y4=INT(.75*Y3)
3930 GOTO 3950
3935 Y4=INT(.85*Y3)
3940 GOTO 3950
3945 Y4=INT(.95*Y3)
3950 PRINT
3955 PRINT "Will you chemically control broadleaf weeds? YES or NO."
3960 INPUT J$

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3965 IF J$="NO" THEN 4000
3970 IF J$="HELP" THEN 4175
3975 IF J$="YES" THEN 3990
3980 GOTO 3950
3985 J$="NO"
3990 Y4=Y3
3995 IF Y4=Y3 THEN 4010
4000 PRINT
4005 PRINT "YOUR YIELD IS REDUCED FROM";Y3;"TO";Y4;"BUSHELS PER ACRE."
4010 PRINT
4015 PRINT "Would you like a recommendation on weed sprays? YES or NO."
4020 INPUT Q$
4025 IF Q$="YES" THEN 4035
4030 GOTO 5840
4035 REM      HELP FOR WEED CONTROL
4040 PRINT
4045 PRINT "*** REMEMBER *** READ AND FOLLOW THE LABEL EXACTLY!!"
4050 PRINT
4055 PRINT "WILD OATS: Spring Wheat use Carbyne or Fargo"
4060 PRINT "          Barley use Avenge, Carbyne, or Fargo"
4065 PRINT "MUSTARD, PIGWEED, RUSSIAN THISTLE, SUNFLOWERS, LAMBSQUARTERS:"
4070 PRINT "          In wheat use 2,4-D ester or amine"
4075 PRINT "          In oats or barley use 2,4-D amine"
4080 PRINT "KOCHIA: Use 2,4-D ester + Bromoxynil"
4085 PRINT "WILD BUCKWHEAT AND COWCOCKLE: Several selections"
4090 PRINT TAB(10)"1. Banvel D + 2,4-D amine"
4095 PRINT TAB(10)"2. Banvel D + MCP amine"
4100 PRINT TAB(10)"3. MCP ester + Bromoxynil"
4105 PRINT TAB(10)"4. 2,4-D ester + Bromoxynil"
4110 GOTO 5840
4115 REM      HELP FOR WILD OAT INFESTATION
4120 PRINT
4125 PRINT "Wild oats (Avena fatua) infestations are considered HIGH with"
4130 PRINT "about 80 plants per square yard, MEDIUM with about 40 plants"
4135 PRINT "per square yard, and LOW with 10 plants per square yard."
4140 PRINT "Enter the level of infestation closest to your situation or"
4142 PRINT "NONE if wild oats are not present."
4145 GOTO 3645
4150 REM      HELP FOR WILD OAT CONTROL
4155 PRINT
4160 PRINT "If you do not control wild oats, your yield will be reduced"
4165 PRINT "according to the level of infestation you entered above."
4170 GOTO 3670
4175 REM      HELP FOR BROADLEAF WEED CONTROL
4180 PRINT
4185 PRINT "If you do not control broadleaf weeds, your yield will be reduced"
4190 PRINT "according to the level of infestation you entered above."
4195 GOTO 3950
4200 REM      HELP FOR GREEN FOXTAIL
4205 PRINT
4210 PRINT "Green Foxtail (Setaria viridis) control is not directly"
4215 PRINT "considered in this program. Type YES for hints on control."
4220 GOTO 3825
4225 REM      HELP FOR BROADLEAF WEEDS
4230 PRINT
4235 PRINT "The following examples may help you decide on your level of"
4240 PRINT "infestation:"
4245 PRINT " HIGH: More than 5 Canada Thistle plants, 50 wild mustard"
4250 PRINT "       plants or 100 wild buckwheat plants per square yard"
4255 PRINT " MEDIUM: 2 to 5 Canada Thistle plants, 25 to 50 wild"
4260 PRINT "       mustard plants, or 50 to 100 wild buckwheat"
4265 PRINT "       plants per square yard."
4270 PRINT " LOW:   1 to 2 Canada Thistle plants, 5 to 25 wild mustard"
4275 PRINT "       plants, or 5 to 50 wild buckwheat plants/sq. yard"
4280 PRINT " NONE:  No broadleaf weed infestation"
4285 GOTO 3875
4295 REM      HELP FOR WILD OAT CONTROL MEASURE
4300 PRINT
4305 PRINT "THERE ARE PRESENTLY FOUR WILD OAT HERBICIDES AVAILABLE FOR USE"

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4310 PRINT "IN SMALL GRAIN PRODUCTION."
4315 PRINT
4320 PRINT TAB(17)"APPROXIMATE"
4325 PRINT "HERBICIDE"TAB(16)"COST PER ACRE"TAB(35)"TIME OF APPLICATION"
4330 PRINT "*****TAB(16)*****TAB(35)*****"
4335 PRINT
4340 PRINT "FARGO"TAB(17)"$8.00-9.00"TAB(35)"LATE FALL BEFORE A SPRING CROP"
4345 PRINT TAB(35)"OR AT PLANTING TIME IN THE SPRING."
4350 PRINT
4355 PRINT "CARBYNE"TAB(17)"$4.00-5.00"TAB(35)"WHEN MAJORITY OF WILD OATS ARE"
4360 PRINT TAB(35)"IN 2 LEAF STAGE."
4365 PRINT
4370 PRINT "AVENGE"TAB(17)"$9.00-11.00"TAB(35)"WHEN MAJORITY OF WILD OATS ARE"
4375 PRINT TAB(35)"IN 3 TO 5 LEAF STAGE."
4380 PRINT
4385 PRINT "HOELON"TAB(17)"$11.00-14.00"TAB(35)"WHEN MAJORITY OF WILD OATS ARE"
4390 PRINT TAB(35)"IN 1 TO 4 LEAF STAGE."
4395 PRINT
4400 GOTO 3685
4405 REM      EXPANDED FARGO HELP
4410 PRINT
4415 PRINT "DO YOU HAVE ANY QUESTIONS REGARDING THE USE OF FARGO?"
4420 PRINT "ENTER YES OR NO."
4425 INPUT Q$
4430 IF Q$="NO" THEN 5830
4435 IF Q$="YES" THEN 4450
4440 GOTO 4420
4445 PRINT
4450 PRINT "INFORMATION IS AVAILABLE FOR THE FOLLOWING QUESTIONS."
4455 PRINT TAB(5)'1. HOW MUCH DOES FARGO COST?'
4460 PRINT TAB(5)'2. WHEN SHOULD FARGO BE APPLIED?'
4465 PRINT TAB(5)'3. HOW SHOULD FARGO BE INCORPORATED?'
4470 PRINT TAB(5)'4. WHAT IS THE DIFFERENCE BETWEEN FARGO LIQUID AND'
4475 PRINT TAB(9)'FARGO GRANULES?'
4480 PRINT TAB(5)'5. HOW SHOULD FARGO GRANULES BE APPLIED?'
4485 PRINT "ENTER THE NUMBER OF THE QUESTION YOU WANT ANSWERED."
4490 PRINT "ENTER STOP TO GO ON WITH THE PROGRAM."
4495 INPUT Q$
4500 IF Q$="STOP" THEN 5790
4505 IF Q$="1" THEN 4535
4510 IF Q$="2" THEN 4570
4515 IF Q$="3" THEN 4610
4520 IF Q$="4" THEN 4665
4525 IF Q$="5" THEM 4710
4530 GOTO 4485
4535 REM      FARGO QUESTION 1
4540 PRINT
4545 PRINT "1. HOW MUCH DOES FARGO COST?"
4550 PRINT "From $8.00 to 9.00 per acre depending on the formulation"
4555 PRINT "used (liquid or granules), rate per acre, and the dealer price."
4560 PRINT "This does not include the cost of application and soil"
4562 PRINT "incorporation."
4565 GOTO 4760
4570 REM      FARGO QUESTIONS 2
4575 PRINT
4580 PRINT "2. WHEN SHOULD FARGO BE APPLIED?"
4585 PRINT "In late fall or at planting time in spring. For spring applications, you can apply FARGO before or after seeding barley."
4590 PRINT "For spring wheat or durum, seed before application. Seed 2 to 3 inches deep so seed is below FARGO treated soil."
4600 PRINT "GOTO 4760
4610 REM      FARGO QUESTION 3
4615 PRINT
4620 PRINT "3. HOW SHOULD FARGO BE INCORPORATED?"
4625 PRINT "Apply herbicide to the soil surface. To avoid loss due to evaporation, incorporate into soil immediately with a harrow, field cultivator or disc to a depth of 2 inches. Incorporate a second time at right angles to the first incorporation to ensure an even, uniform application. Do not incorporate deeper"

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4650 PRINT "than 2 inches. RULE OF THUMB: herbicide is incorporated one-half"
4655 PRINT "depth tool is working."
4660 GOTO 4760
4665 REM      FARGO QUESTION 4
4670 PRINT
4675 PRINT "4. WHAT IS THE DIFFERENCE BETWEEN FARGO LIQUID AND FARGO GRANULES?"
4680 PRINT "Granules are clay particles with FARGO on surface - excellent"
4685 PRINT "for fall applications and trashy conditions since granules sift"
4690 PRINT "through the trash. Liquid is slightly more consistent than gran-"
4695 PRINT "ules when applied in the spring. Avoid using liquid with lots"
4700 PRINT "of straw on the soil surface."
4705 GOTO 4760
4710      FARGO QUESTION 5
4715 PRINT
4720 PRINT "5. HOW SHOULD FARGO GRANULES BE APPLIED?"
4725 PRINT "With a special granule applicator. Dealers often rent them for"
4730 PRINT "a nominal fee. Granules are much finer than dry fertilizer so"
4735 PRINT "grass seed attachments and fertilizer spreaders are not accurate"
4740 PRINT "enough. You must apply about two gallons of fine particles"
4745 PRINT "uniformly to one acre of land and it takes a special applicator"
4750 PRINT "to achieve this. Granules may be applied by air."
4755 GOTO 4760
4760 REM      RESTART FARGO QUESTIONS
4765 PRINT
4770 PRINT "Do you want to see answers to any of the other Fargo questions?"
4772 PRINT "ENTER YES OR NO."
4775 INPUT Q$
4780 IF Q$="YES" THEN 4485
4785 IF Q$="NO" THEN 4792
4790 GOTO 4765
4792 GOSUB 4795
4793 GOTO 5790
4795 REM      GENERAL STATEMENT
4800 PRINT
4805 PRINT "If you are a first time user, ask your dealer and neighbors who"
4810 PRINT "have used";A$;"for advice. First time users frequently make"
4815 PRINT "mistakes when applying";A$;". Please read the label thoroughly"
4820 PRINT "for best results. If you have additional questions, see your"
4822 PRINT "County Agent."
4825 RETURN
4830 REM      EXPANDED CARBYNE HELP
4835 PRINT
4840 PRINT "Do you have any questions regarding the use of carbyne?"
4845 PRINT "Enter YES or NO."
4850 INPUT Q$
4855 IF Q$="NO" THEN 5830
4860 IF Q$="YES" THEN 4870
4865 GOTO 4840
4870 PRINT
4875 PRINT "Information is available for the following questions."
4880 PRINT TAB(5)"1. HOW MUCH DOES CARBYNE COST?"
4885 PRINT TAB(5)"2. WHEN IS THE RECOMMENDED TIME TO APPLY CARBYNE?"
4890 PRINT TAB(5)"3. WHEN DOES CARBYNE WORK BEST?"
4895 PRINT "Enter the number of the question you want answered."
4900 PRINT "Enter STOP to go on with the program."
4905 INPUT Q$
4910 IF Q$="STOP" THEN 5790
4915 IF Q$="1" THEN 4935
4920 IF Q$="2" THEN 4960
4925 IF Q$="3" THEN 5005
4930 GOTO 4895
4935 REM      CARBYNE QUESTION 1
4940 PRINT
4945 PRINT "Carbyne costs from $4.00 to $6.00 per acre depending on the"
4950 PRINT "rate of application. This does not include the cost of applying."
4955 GOTO 5050
4960 REM      CARBYNE QUESTION 2
4965 PRINT
4970 PRINT "1. WHEN IS THE RECOMMENDED TIME TO APPLY CARBYNE?"

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4975 PRINT "When the majority of the wild oats are in the two-leaf stage."
4980 PRINT "Take a piece of paper and record leaf stage of 20 randomly"
4985 PRINT "selected wild oat plants. Calculate the percent in the 1, 1 1/2,"
4990 PRINT "2, 2 1/2, and 3 leaf stages. Apply Carbyne when the majority are"
4995 PRINT "in the two-leaf stage for best results."
5000 GOTO 5050
5005 REM      CARBYNE QUESTION 3
5010 PRINT
5015 PRINT "3. WHEN DOES CARBYNE WORK BEST?"
5020 PRINT "When wild oat plants are growing vigorously. Low fertility,"
5025 PRINT "drought stress, high temperatures or poor crop competition can"
5030 PRINT "reduce effectiveness of Carbyne. Do not spray wet plants. Apply"
5035 PRINT "in 5 gallons of water per acre at 45 pounds of pressure per square"
5040 PRINT "inch or more. This provides a fine mist and improved plant"
5042 PRINT "coverage."
5045 GOTO 5050
5050 REM      RESTART CARBYNE QUESTIONS
5055 PRINT
5060 PRINT "Do you want to see answers to any of the other Carbyne questions?"
5065 PRINT "Enter YES or NO."
5070 INPUT Q$
5075 IF Q$="YES" THEN 4895
5080 IF Q$="NO" THEN 5090
5085 GOTO 5055
5090 REM      GENERAL CARBYNE STATEMENT
5095 GOSUB 4795
5100 GOTO 5790
5105 REM      EXPANDED AVENGE HELP
5110 PRINT
5115 PRINT "Do you have any questions regarding the use of avenge?"
5120 PRINT "Enter YES or NO."
5125 INPUT Q$
5130 IF Q$="NO" THEN 5830
5135 IF Q$="YES" THEN 5145
5140 GOTO 5115
5145 PRINT
5150 PRINT "Information is available for the following questions."
5155 PRINT TAB(5)"1. HOW MUCH DOES AVENGE COST?"
5160 PRINT TAB(5)"2. WHEN IS THE PROPER TIME TO APPLY AVENGE?"
5165 PRINT TAB(5)"3. WHAT CROPS CAN BE SPRAYED WITH AVENGE?"
5170 PRINT TAB(5)"4. CAN AVENGE BE TANK-MIXED?"
5175 PRINT TAB(5)"5. WHEN DOES AVENGE WORK BEST?"
5180 PRINT TAB(5)"6. HOW MUCH AVENGE SHOULD BE APPLIED?"
5185 PRINT "Enter the number of the question you want answered."
5190 PRINT "Enter stop to go on with the program."
5195 INPUT Q$
5200 IF Q$="STOP" THEN 5790
5205 IF Q$="1" THEN 5240
5210 IF Q$="2" THEN 5270
5215 IF Q$="3" THEN 5310
5220 IF Q$="4" THEN 5350
5225 IF Q$="5" THEN 5385
5230 IF Q$="6" THEN 5430
5235 GOTO 5185
5240 REM      AVENGE QUESTION 1
5245 PRINT
5250 PRINT "1. HOW MUCH DOES AVENGE COST?"
5255 PRINT "Approximately $9.00 to $11.00 per acre depending upon the rate"
5260 PRINT "of application."
5265 GOTO 5465
5270 REM      AVENGE QUESTION 2
5275 PRINT
5280 PRINT "2. WHEN IS THE PROPER TIME TO APPLY AVENGE?"
5285 PRINT "When the majority of the wild oats are in the 3 to 5 leaf stage."
5290 PRINT "Select 20 individual wild oat plants and record the leaf stage"
5295 PRINT "of each. Compute the percentage of plants in the 2, 2 1/2, 3,"
5300 PRINT "3 1/2, 4 etc. leaf stage. Apply when the majority are in the"
5302 PRINT "3 to 5 leaf stage."
5305 GOTO 5465

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5310 REM      AVENGE QUESTION 3
5315 PRINT
5320 PRINT "3. WHAT CROPS CAN BE SPRAYED WITH AVENGE?"
5325 PRINT "All Barley and fall-seeded wheat, Olaf and Era spring wheat"
5330 PRINT "varieties (caution: Certain spring wheat varieties including"
5335 PRINT "Bonanza, Bounty, Lark, Waldron, and WS1809 are sensitive to Avenge)"
5340 PRINT "and all varieties of Durum wheat except Lakota and Wascana."
5345 GOTO 5465
5350 REM      AVENGE QUESTION 4
5355 PRINT
5360 PRINT "4. CAN AVENGE BE TANK-MIXED?"
5365 PRINT "Yes. You can mix Avenge with MCPA Amine, Bromoxynil, MCPA Plus"
5370 PRINT "Bromoxynil, 2,4-D Ester, and 2,4,-D Amine. Avenge can be applied by"
5375 PRINT "Ground or air."
5380 GOTO 5465
5385 REM      AVENGE QUESTION 5
5390 PRINT
5395 PRINT "5. WHEN DOES AVENGE WORK BEST?"
5400 PRINT "When temperature, moisture, and fertility favor vigorous wild oat"
5405 PRINT "growth. If applied under stress, some yellowing of leaf tips of"
5410 PRINT "the crop can occur but full crop recovery usually occurs before"
5415 PRINT "harvest. Wild oats usually reach the three-leaf stage about nine"
5420 PRINT "days after they emerge. Often the crop is about one leaf stage"
5422 PRINT "ahead of the wild oat."
5425 GOTO 5465
5430 REM      AVENGE QUESTION 6
5435 PRINT
5440 PRINT "6. HOW MUCH AVENGE SHOULD BE APPLIED?"
5445 PRINT "This depends upon density of infestation. The more wild oats, the"
5450 PRINT "more Avenge you need for good plant coverage. See label for"
5455 PRINT "further instructions."
5460 GOTO 5465
5465 REM      RESTART AVENGE QUESTIONS
5470 PRINT
5475 PRINT "Do you want to see answers to any of the other Avenge questions?"
5480 PRINT "Enter YES or NO."
5485 INPUT Q$
5490 IF Q$="YES" THEN 5185
5495 IF Q$="NO" THEN 5505
5500 GOTO 5470
5505 GOSUB 4795
5510 GOTO 5790
5515 REM      EXPANDED HOELON HELP
5520 PRINT
5525 PRINT "Do you have any questions regarding the use of Hoelon?"
5530 PRINT "Enter YES or NO."
5535 INPUT Q$
5540 IF Q$="NO" THEN 5830
5545 IF Q$="YES" THEN 5555
5550 GOTO 5520
5555 PRINT
5560 PRINT "Information is available for the following questions."
5565 PRINT TAB(5)"1. HOW MUCH DOES HOELON COST?"
5570 PRINT TAB(5)"2. WHEN SHOULD HOELON BE APPLIED?"
5575 PRINT TAB(5)"3. HOW LONG DOES IT TAKE HOELON TO WORK?"
5580 PRINT "Enter the number of the question you want answered."
5585 PRINT "Enter STOP to continue with the program."
5590 INPUT Q$
5595 IF Q$="STOP" THEN 5790
5600 IF Q$="1" THEN 5620
5605 IF Q$="2" THEN 5645
5610 IF Q$="3" THEN 5695
5615 GOTO 5580
5620 REM      HOELON QUESTION 1
5625 PRINT
5630 PRINT "1. HOW MUCH DOES HOELON COST?"
5635 PRINT "From $11.00 to $14.00 per acre depending upon the rate."
5640 GOTO 5740
5645 REM      HOELON QUESTION 2

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5650 PRINT
5655 PRINT "2. WHEN SHOULD HOELON BE APPLIED?"
5660 PRINT "When the majority of Wild oats or Green Foxtail (Pigeongrass) are"
5665 PRINT "in the 1 to 4 leaf stage. Persian Wildrye (darnel) must be in the"
5670 PRINT "1 to 3 leaf stage for best results. Record leaf stage of twenty"
5675 PRINT "individual plants in the field to be treated. Figure the percen-"
5680 PRINT "tage of plants in the 1, 1 1/2, 2, 2 1/2 3, 3 1/2, 4(and higher)"
5685 PRINT "leaf stage to determine the best time to apply Hoelon."
5690 GOTO 5740
5695 REM      HOELON QUESTION 3
5700 PRINT
5705 PRINT "3. HOW LONG DOES IT TAKE HOELON TO WORK?"
5710 PRINT "Hoelon works slowly. First symptoms appear in a week or so with"
5715 PRINT "mottled white spots on leaf blades. Do not tank mix or apply"
5720 PRINT "another product within one week of Hoelon application. For good"
5725 PRINT "plant coverage it is essential to use 10 gallons of water per acre"
5730 PRINT "for ground application and 5 gallons per acre by air."
5735 GOTO 5740
5740 REM      RESTART HOELON QUESTIONS
5745 PRINT
5750 PRINT "Do you want to see answers to any of the other Hoelon questions?"
5755 PRINT "Enter YES or NO."
5760 INPUT Q$
5765 IF Q$="YES" THEN 5580
5770 IF Q$="NO" THEN 5780
5775 GOTO 5750
5780 GOSUB 4795
5785 GOTO 5790
5790 REM      RESTART FOR WILD OAT CONTROL
5795 PRINT
5800 PRINT "Would you like to choose another wild oat control measure?"
5805 PRINT "Enter YES or NO."
5810 INPUT Q$
5815 IF Q$="YES" THEN 3680
5820 IF Q$="NO" THEN 5830
5825 GOTO 5800
5830 A$="YES"
5835 GOTO 3805
5840 CHAIN "MOD6",5850,ALL

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10 CHAIN "FLEXCROP",15
5845 REM ****
5850 REM SOIL FERTILITY SUBROUTINE
5855 REM ****
5860 PRINT
5865 PRINT"This is the soil fertility part of the program."
5870 PRINT"You must have soil test results to get accurate fertilizer"
5875 PRINT"Recommendations. If you do not have a soil test,"
5880 PRINT"a fertilizer recommendation will be made for you based on"
5885 PRINT"research experience."
5890 PRINT
5895 PRINT"Do you have soil test results? Input N, P, BOTH, OR NONE."
5900 INPUT E$
5905 IF E$="NONE" THEN 5935
5910 IF E$="HELP" THEN 7080
5915 IF E$="N" THEN 5935
5920 IF E$="P" THEN 6270
5925 IF E$="BOTH" THEN 6270
5930 GOTO 5895
5935 REM PHOSPHORUS RECOMMENDATION, NO SOIL TEST
5940 P6=90
5945 GOSUB 6725
5950 IF F2<90 THEN 5965
5955 Y5=Y4
5960 GOTO 6035
5965 IF T$="MF" THEN 5980
5970 P8=.282*(F2*.44)+7
5975 GOTO 5985
5980 P8=.228*(F2*.44)+7
5985 IF C$="SAFFLOWER" THEN 6000
5990 R=(4*P8+36)/100
5995 GOTO 6040
6000 IF L$="FALLOW" THEN 6020
6005 R=.04*P8+.345
6010 IF R>1 THEN 6035
6015 GOTO 6040
6020 R=.05*P8+.19
6025 IF R>1 THEN 6035
6030 GOTO 6040
6035 R=1
6040 Y5=Y4*R
6045 IF Q$="N" THEN 6550
6050 REM NITROGEN RECOMMENDATION, NO SOIL TEST
6055 IF L$="FALLOW" THEN 6150
6060 F=INT(((Y5*V)-30)+.5)
6065 F6=F
6070 IF F>0 THEN 6080
6075 F=0
6080 PRINT
6085 PRINT"The nitrogen fertilizer recommendation on recrop is";F;"lb N/A"
6090 PRINT"How much nitrogen will you apply? (lb/A)"
6095 INPUT Q$
6100 IF Q$="HELP" THEN 7275
6105 F1=VAL(Q$)
6110 F5=F1
6115 IF F6>0 THEN 6130
6120 F1=F6
6125 GOTO 6140
6130 IF F1<=F THEN 6140
6135 F1=F
6140 Y5=INT(((30+F1)*(1/V))+.5)
6145 GOTO 6255
6150 REM N RECOMMENDATION, FALLOW
6155 IF C$="SAFFLOWER" THEN 6170
6160 PRINT"Your nitrogen fertilizer needs are 10 to 15 lb N/acre"
6165 GOTO 6250
6170 IF T$<>"MF" THEN 6185
6175 PRINT"Your nitrogen needs are 0 lb N/acre"
6180 GOTO 6250

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6185 F=INT((Y5*.05)-70)
6190 IF F<=0 THEN 6250
6195 GOTO 6250
6200 PRINT "Your N fertilizer needs are ";F;" lb N/acre."
6205 PRINT "How much will you apply?"
6210 INPUT Q$
6215 IF Q$="HELP" THEN 7245
6220 F5=VAL(Q$)
6225 IF F5>F THEN 6235
6230 GOTO 6240
6235 F5=F
6240 Y5=INT((F5+70)/.05)
6245 GOTO 6255
6250 F5=0
6255 IF E$="P" THEN 6685
6260 IF E$="NONE" THEN 6680
6265 IF E$="N" THEN 6680
6270 REM      PHOSPHORUS RECOMMENDATION, WITH SOIL TEST
6275 PRINT
6280 PRINT "Do you have Bray or Sodium Bicarbonate test results for"
6285 PRINT "Phosphorus? Enter BRAY or BICARB."
6290 INPUT X$
6295 IF X$="BICARB" THEN 6345
6300 IF X$="HELP" THEN 7110
6305 IF X$="BRAY" THEN 6315
6310 GOTO 6275
6315 PRINT "Input bray phosphorus level in PPM."
6320 INPUT Q$
6325 IF Q$="HELP" THEN 7145
6330 V9=VAL(Q$)
6335 P5=.189*V9+2.379
6340 GOTO 6365
6345 PRINT "Input the sodium bicarbonate phosphorus level in PPM."
6350 INPUT Q$
6355 IF Q$="HELP" THEN 7165
6360 P5=VAL(Q$)
6365 IF T$="MF" THEN 6380
6370 P6=INT(((16.1-P5)/(.282*.44)))
6375 GOTO 6385
6380 P6=INT(((16.1-P5)/(.228*.44)))
6385 IF P6<=0 THEN 6400
6390 GOSUB 6725
6395 GOTO 6440
6400 PRINT
6405 PRINT "Phosphorus fertilizer is not needed, however 15 to 20 pounds"
6410 PRINT "of P2O5 per acre could be applied as a maintenance rate."
6415 PRINT "How much P2O5 will you apply? lb P2O5/acre (broadcast equivalent)"
6420 INPUT Q$
6425 F2=VAL(Q$)
6430 Y5=Y4
6435 GOTO 6545
6440 IF F2=P6 THEN 6505
6445 IF T$="MF" THEN 6460
6450 P8=.282*(F2*.44)+P5
6455 GOTO 6465
6460 P8=.228*(F2*.44)+P5
6465 IF C$="SAFFLOWER" THEN 6475
6470 GOTO 6520
6475 IF L$="FALLOW" THEN 6490
6480 R=.041*P8+.345
6485 GOTO 6495
6490 R=.05*P8+.19
6495 IF R>1 THEN 6505
6500 GOTO 6510
6505 R=1
6510 Y5=Y4*R
6515 GOTO 6530
6520 R=(4*P8+36)/100
6525 Y5=INT(Y4*R+.5)

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6530 IF Y5=Y4 THEN 6545
6535 PRINT
6540 PRINT "INCOMPLETE P FERTILIZATION REDUCED YIELD FROM ";Y4
6541 IF C$="SAFFLOWER" THEN 6544
6542 PRINT "TO ";Y5;" BU/ACRE."
6543 GOTO 6545
6544 PRINT "TO ";Y5;" LB/ACRE."
6545 IF E$="P" THEN 6050
6550 REM      NITROGEN RECOMMENDATION, WITH SOIL TEST
6555 PRINT
6560 PRINT "What is your soil test value for nitrogen lb/acre to 4ft?"
6565 INPUT Q$
6570 IF Q$="HELP" THEN 7185
6575 N1=VAL(Q$)
6580 N3=INT((Y5*V-N1)+.5)
6585 IF N3>=0 THEN 6595
6590 N3=0
6595 PRINT
6600 PRINT "Your nitrogen fertilizer needs are";N3;" lb N/acre"
6605 PRINT "How much N will you apply? LB N/ACRE"
6610 INPUT Q$
6615 IF Q$="HELP" THEN 7215
6617 F1=VAL(Q$)
6625 F5=F1
6630 IF F1>=N3 THEN 6640
6635 IF F1<N3 THEN 6650
6640 F1=N3
6645 GOTO 6680
6650 Y5=INT(((N1+F1)*(1/V))+.5)
6655 IF C$="SAFFLOWER" THEN 6675
6660 PRINT
6665 PRINT "YOUR YIELD IS REDUCED TO ";Y5;" BUSHELS PER ACRE."
6670 GOTO 6680
6675 PRINT "YOUR YIELD IS REDUCED TO ";Y5;" POUNDS PER ACRE."
6680 REM      POTASSIUM AND MICRONUTRIENT STATEMENT
6685 PRINT
6690 PRINT "If your K soil test is less than 200 PPM, there is a chance"
6695 PRINT "of a potassium fertilizer response and the recommended"
6700 PRINT "rate is 40 lb K2O/acre."
6705 PRINT
6710 PRINT "Micronutrients are generally no problem on small grains and"
6715 PRINT "micronutrient fertilizers are not recommended."
6720 GOTO 7310
6725 REM      SUBROUTINE FOR BANDED VS. BROADCAST PHOSPHATE
6730 REM      COMPUTE BANDED AND BROADCAST RATE
6735 P7=INT(P6*.67)
6740 REM      REQUEST P205 LEVEL
6745 PRINT
6750 PRINT "Your P205 fertilizer needs are";P7;" pounds per acre banded"
6755 PRINT "with the seed or";P6;" pounds per acre broadcast."
6760 PRINT
6765 PRINT "Will you band or broadcast the phosphorus?"
6770 PRINT "Enter BAND, BROADCAST, OR SPLIT."
6775 INPUT D$
6780 IF D$="SPLIT" THEN 6800
6785 IF D$="HELP" THEN 6950
6790 GOTO 6890
6795 REM      SECTION FOR SPLIT APPLICATION
6800 PRINT
6805 PRINT "How many pounds of P205 per acre will you band with the seed?"
6810 INPUT Q$
6815 IF Q$="HELP" THEN 7015
6820 F3=VAL(Q$)
6825 F4=F3*1.5
6830 P9=F4
6835 F5=INT((P6-F4)*10)/10
6840 IF F5>=0 THEN 6850
6845 GOTO 6935
6850 PRINT

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6855 PRINT "Your remaining phosphorus requirement is";F5;"pounds of"
6860 PRINT "P205 per acre. How many pounds will you broadcast?"
6865 INPUT Q$
6870 IF Q$="HELP" THEN 7050
6875 F6=VAL(Q$)
6880 F2=F6+F4
6885 GOTO 6935
6890 PRINT
6895 PRINT "How much will you apply in pounds of P205 per acre?"
6900 INPUT Q$
6905 IF Q$="HELP" THEN 6985
6910 F2=VAL(Q$)
6915 P9=F2
6920 IF D$="BAND" THEN 6930
6925 GOTO 6935
6930 F2=F2*1.5
6935 IF F2<=P6 THEN 6945
6940 F2=P6
6945 RETURN
6950 REM HELP FOR BANDED VS. BROADCAST
6955 PRINT
6960 PRINT "Broadcast refers to phosphorus spread on the surface and"
6965 PRINT "incorporated. Band refers to phosphorus placed with the seed"
6970 PRINT "through the drill. Broadcast phosphorus is positionally unavailable"
6975 PRINT "the first year and a higher rate is required."
6980 GOTO 6765
6985 REM HELP FOR PHOSPHORUS RATE
6990 PRINT
6995 PRINT "Choose the appropriate rate depending on whether you band the"
7000 PRINT "fertilizer with the seed or broadcast it. Applying less than the"
7005 PRINT "recommended amount will result in a yield reduction."
7010 GOTO 6890
7015 REM HELP FOR SPLIT APPLICATION
7020 PRINT
7025 PRINT "Since you chose to split the application, enter the number"
7030 PRINT "of pounds of P205 per acre you will band with the seed. You"
7035 PRINT "will be given the opportunity of broadcasting all or part"
7040 PRINT "of the remainder."
7045 GOTO 6805
7050 REM HELP FOR SPLIT BROADCAST PORTION
7055 PRINT
7060 PRINT "Enter the number of pounds of P205 you will broadcast per acre"
7065 PRINT "in addition to the quantity banded with the seed."
7070 GOTO 6850
7075 REM HELP FOR FERTILITY SECTION
7080 PRINT
7085 PRINT "Enter P if you have just a phosphorus soil test"
7090 PRINT "N if you have just a nitrogen soil test"
7095 PRINT "BOTH if you have both N and P soil test"
7100 PRINT "NONE if you don't have soil test information."
7105 GOTO 5895
7110 REM HELP FOR BRAY VS. BICARB SOIL TEST
7115 PRINT
7120 PRINT "The Bray soil test refers to the type of test routinely run"
7125 PRINT "at Montana State University. Bicarb refers to the soil test"
7130 PRINT "using sodium bicarbonate extract. Bicarb is done by other"
7135 PRINT "labs, including North Dakota State University."
7140 GOTO 6275
7145 REM HELP FOR PPM BRAY PHOSPHORUS
7150 PRINT
7155 PRINT "Enter the Bray soil test level for phosphorus in PPM"
7160 GOTO 7165
7165 REM HELP FOR PPM BICARB PHOSPHORUS
7170 PRINT
7175 PRINT "Enter the bicarbonate soil test level for phosphorus in PPM"
7180 GOTO 6345
7185 REM HELP FOR N SOIL TEST
7190 PRINT
7195 PRINT "For accurate nitrogen recommendations, Montana State University"

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7200 PRINT"recommends testing for Nitrate-Nitrogen (NO3-N) to a depth of"
7205 PRINT"four feet or a root-restricting layer."
7210 GOTO 6555
7215 REM      HELP FOR FERTILIZER RATE
7220 PRINT
7225 PRINT"If you apply less than the recommended amount of fertilizer"
7230 PRINT"your yield will be reduced accordingly. Applying an excess amount"
7235 PRINT"will not increase yield, just the cost."
7240 GOTO 6595
7245 REM      HELP FOR FERTILIZER RATE
7250 PRINT
7255 PRINT"If you apply less than the recommended amount of fertilizer,"
7260 PRINT"your yield will be reduced accordingly. Applying an excess amount"
7265 PRINT"will not increase yield, just the cost."
7270 GOTO 6205
7275 REM      HELP FOR FERTILIZER RATE
7280 PRINT
7285 PRINT"If you apply less than the recommended amount of fertilizer,"
7290 PRINT"your yield will be reduced accordingly. Applying an excess amount"
7295 PRINT"will not increase the yield, just the cost."
7300 GOTO 6090
7310 REM      ****
7315 REM      SEEDING DATE SUBROUTINE FOR SMALL GRAIN
7320 REM      ****
7322 IF C$="SAFFLOWER" THEN 7530
7323 IF C$="W WHEAT" THEN 7440
7325 IF Y5/Y4>.7 THEN 7345
7330 IF Y5/Y4<.5 THEN 7355
7335 Z6=.21
7340 GOTO 7360
7345 Z6=.4
7350 GOTO 7360
7355 Z6=.16
7360 IF X3=1 THEN 7405
7365 IF X3=2 THEN 7405
7370 IF X3=4 THEN 7405
7375 IF X3=5 THEN 7405
7380 REM      CALCULATION FOR EASTERN MONTANA
7385 IF Z3<=135 THEN 7440
7390 IF Z3>166 THEN 7430
7395 Z5=(Z3-135)*Z6
7400 GOTO 7450
7405 REM      CALCULATION FOR CENTRAL MONTANA
7410 IF Z3<=110 THEN 7440
7415 IF Z3>166 THEN 7430
7420 Z5=(Z3-110)*Z6
7425 GOTO 7450
7430 Y6=INT(.1*Y5)
7435 GOTO 7490
7440 Z5=0
7445 GOTO 7450
7450 REM      YIELD EQUATION FOR SEEDING DATE
7455 IF C$="S WHEAT" THEN 7485
7460 IF C$="OATS" THEN 7475
7465 Y6=INT(Y5-(Z5*1.25))
7470 GOTO 7490
7475 Y6=INT(Y5-(Z5*1.875))
7480 GOTO 7490
7485 Y6=INT(Y5-Z5)
7490 IF Y6<0 THEN 7500
7495 GOTO 7505
7500 Y6=0
7505 IF Y5=Y6 THEN 7520
7510 PRINT
7515 PRINT "LATE SEEDING REDUCED YOUR YIELD FROM ";Y5;" TO ";Y6;" BU/ACRE."
7520 CHAIN "MOD7",7525,ALL
7530 REM      SAFFLOWER SEEDING DATE
7535 IF Z3<=135 THEN 7570
7537 IF Z3>152 THEN 7555
7540 R=1-((Z3-135)*1.5)/100
7545 Y6=Y5*R
7550 GOTO 7575
7555 R=.01
7560 Y6=Y5*R
7565 GOTO 7575
7570 Y6=Y5
7575 GOTO 7520

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10 CHAIN "FLEXCROP",15
7525 REM *****
7530 REM      YIELD SUMMARY MODULE
7535 REM *****
7540 E1=INT(-(((Y7-Y2)/Y7)*100)+.5)
7545 E2=INT(-(((Y2-Y4)/Y2)*100)+.5)
7550 E3=INT(-(((Y4-Y5)/Y4)*100)+.5)
7555 E4=INT(-(((Y5-Y6)/Y5)*100)+.5)
7560 E5=INT(-(((Y-Y7)/Y)*100)+.5)
7565 PRINT
7570 PRINT
7575 PRINT TAB(10)***** CROP MANAGEMENT ANALYSIS *****
7580 PRINT
7585 PRINT TAB(12)||C$|
7590 PRINT TAB(12)||FOLLOWING ||L$|
7595 PRINT
7600 PRINT TAB(10)||THIS IS HOW THE AGRONOMIC FACTORS AFFECTED YIELD:|
7602 PRINT
7605 PRINT TAB(14)||FACTOR||TAB(35)||YIELD||TAB(54)||PERCENT|
7610 PRINT TAB(14)||-----||TAB(35)||-----||TAB(54)||-----|
7615 PRINT TAB(13)||BASE YIELD||TAB(35)||||Y|
7620 PRINT TAB(13)||ROTATION||TAB(35)||||Y7;TAB(56)||||E5|
7625 PRINT TAB(13)||VARIETY||TAB(35)||||Y2;TAB(56)||||E1|
7630 PRINT TAB(13)||WEEDS||TAB(35)||||Y4;TAB(56)||||E2|
7635 PRINT TAB(13)||FERTILITY||TAB(35)||||Y5;TAB(56)||||E3|
7640 PRINT TAB(13)||DATE||TAB(35)||||Y6;TAB(56)||||E4|
7645 PRINT
7650 PRINT TAB(10)||The percent column gives the amount of increase|
7655 PRINT TAB(10)||or reduction in yield due to management decisions.|
7660 PRINT
7665 PRINT TAB(10)*****|
7667 GOTO 9210
7670 REM *****
7675 REM      ECONOMICS MODULE
7680 REM *****
7685 A7=0 : A8=0
7690 PRINT
7695 PRINT "What do you anticipate the harvest price of this crop will be"
7700 IF C$="SAFFLOWER" THEN 7715
7705 PRINT "in dollars per bushel."
7710 GOTO 7720
7715 PRINT "in dollars per ton."
7720 INPUT Q$
7725 IF Q$="HELP" THEN 9165
7730 P1=VAL(Q$)
7732 GOTO 7803
7733 REM      HELP FOR ECONOMIC ANALYSIS
7735 PRINT
7740 PRINT "You will be asked for the following information. PLEASE READ"
7745 PRINT "THE QUESTIONS CAREFULLY."
7750 PRINT "SEEDING RATE (LB/A) AND THE COST OF SEED ($/CWT)"
7755 PRINT "COST OF NITROGEN FERTILIZER ($/LB)"
7760 PRINT "COST OF PHOSPHOROUS FERTILIZER ($/LB OF P205)"
7765 PRINT "COST OF WILD OAT CONTROL (COST OF CHEMICAL AND APPLICATION)"
7770 PRINT "COST OF BROADLEAF CONTROL (COST OF CHEMICAL AND APPLICATION)"
7775 PRINT "VARIABLE MACHINERY COSTS PER ACRE (FUEL, OIL, REPAIRS, ETC.)"
7780 PRINT "TIME SPENT PER ACRE AND LABOR RATE PER HOUR"
7785 PRINT "Help messages are provided which give average costs of these items."
7790 PRINT "You may also wish to consult the CROPBUDGET program which gives"
7795 PRINT "more detailed information."
7800 PRINT
7802 GOTO 9230
7803 PRINT
7805 PRINT "What is your SEEDING RATE in POUNDS PER ACRE?"
7810 INPUT Q$
7815 IF Q$="HELP" THEN 9080
7820 A1=VAL(Q$)
7825 PRINT
7830 PRINT "What is your COST OF SEED ($/CWT)?"

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7835 INPUT Q$
7840 IF Q$="HELP" THEN 9120
7845 A2=VAL(Q$)
7850 B1=A1*A2/100
7855 IF F5<>0 THEN 7870
7860 A4=0
7865 GOTO 7900
7870 PRINT
7875 PRINT "How much will you pay for NITROGEN in DOLLARS PER POUND OF ACTUAL N?"
7880 INPUT Q$
7885 IF Q$="HELP" THEN 8670
7890 A3=VAL(Q$)
7895 A4=A3*F5
7900 IF P9<>0 THEN 7915
7905 A6=0
7910 GOTO 7960
7915 PRINT
7920 PRINT "How much will you pay for PHOSPHORUS in DOLLARS PER POUND OF P2O5?"
7925 INPUT Q$
7930 IF Q$="HELP" THEN 8690
7935 A5=VAL(Q$)
7940 A6=A5*P9
7945 IF A$<>"NONE" THEN 7960
7950 A7=0
7955 GOTO 7990
7960 PRINT
7965 PRINT "What is your cost for WILD OAT CONTROL in DOLLARS PER ACRE?"
7970 PRINT "Include both the chemical cost and the cost of application."
7975 INPUT Q$
7980 IF Q$="HELP" THEN 8710
7985 A7=VAL(Q$)
7990 IF J$="YES" THEN 8005
7995 A8=0
8000 GOTO 8035
8005 PRINT
8010 PRINT "What is your cost for BROADLEAF WEED CONTROL in DOLLARS PER ACRE?"
8015 PRINT "Include both the chemical cost and the cost of application."
8020 INPUT Q$
8025 IF Q$="HELP" THEN 8735
8030 A8=VAL(Q$)
8035 B3=A7+A8
8040 PRINT
8045 PRINT "What are your VARIABLE MACHINERY COSTS PER ACRE?"
8050 INPUT Q$
8055 IF Q$="HELP" THEN 8760
8060 A9=VAL(Q$)
8065 PRINT
8070 PRINT "Please input the number of HOURS PER ACRE spent on all operations."
8075 INPUT Q$
8080 IF Q$="HELP" THEN 8835
8085 B8=VAL(Q$)
8090 PRINT
8095 PRINT "Input the average COST OF LABOR per hour in dollars."
8100 INPUT Q$
8105 IF Q$="HELP" THEN 8910
8110 B9=VAL(Q$)
8115 B7=B8*B9
8225 PRINT
8230 PRINT "Fixed costs are incurred whether or not production takes place."
8235 PRINT "However, fixed costs, other than return to the land investment are"
8240 PRINT "included here in order to determine the return to the land"
8245 PRINT "investment."
8250 PRINT
8255 PRINT "What are your TAXES PER ACRE on the land?"
8260 INPUT Q$
8265 IF Q$="HELP" THEN 8935
8270 C1=VAL(Q$)
8275 PRINT
8280 PRINT "What are your INSURANCE COSTS PER ACRE?"

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8285 INPUT Q$
8290 IF Q$="HELP" THEN 8960
8295 C2=VAL(Q$)
8300 PRINT
8305 PRINT "What are your MACHINERY OWNERSHIP COSTS PER ACRE?"
8310 INPUT Q$
8315 IF Q$="HELP" THEN 8985
8320 C3=VAL(Q$)
8325 PRINT
8330 PRINT "What do you assume your RETURN TO MANAGEMENT should be in Percent?"
8335 INPUT Q$
8340 IF Q$="HELP" THEN 9060
8345 C4=VAL(Q$)
8350 REM      ECONOMIC SUMMARY
8355 B5=INT((B1+A4+A6+B3+A9+B7)*100)/100
8360 IF C$="SAFFLOWER" THEN 8375
8365 C7=P1*Y6
8370 GOTO 8380
8375 C7=P1*(Y6/2000)
8380 B4=INT((C7-B5)*100)/100
8385 C5=(C1+C2+C3+(C7*(C4/100)))
8390 C4=(C7*(C4/100))
8395 C6=B4-C5
8400 REM      ECONOMIC SUMMARY TABLE
8405 PRINT
8410 PRINT
8415 PRINT TAB(15)***** ECONOMIC ANALYSIS *****
8420 PRINT
8425 PRINT TAB(17)||C$|
8430 PRINT TAB(17)||FOLLOWING ||L$|
8435 PRINT
8440 PRINT TAB(17)||VARIABLE COSTS PER ACRE:|
8445 PRINT
8450 PRINT TAB(17)||SEED||TAB(45);:PRINT USING "###.##";B1
8470 PRINT TAB(17)||NITROGEN||TAB(45);:PRINT USING "###.##";A4
8480 PRINT TAB(17)||PHOSOPHORUS||TAB(45);:PRINT USING "###.##";A6
8490 PRINT TAB(17)||WEED CONTROL||TAB(45);:PRINT USING "###.##";B3
8500 PRINT TAB(17)||MACHINERY||TAB(45);:PRINT USING "###.##";A9
8510 PRINT TAB(17)||LABOR||TAB(45);:PRINT USING "###.##";B7
8515 PRINT TAB(17)||-----||TAB(45)|_
8520 PRINT TAB(17)||TOTAL||TAB(45);:PRINT USING "###.##";B5
8530 PRINT
8532 PRINT "Enter C to continue."
8533 INPUT Q$
8535 PRINT TAB(17)||FIXED COSTS PER ACRE (EXCEPT LAND):|
8540 PRINT
8550 PRINT TAB(17)||TAXES||TAB(45);:PRINT USING "###.##";C1
8560 PRINT TAB(17)||INSURANCE||TAB(45);:PRINT USING "###.##";C2
8570 PRINT TAB(17)||MACHINERY OWNERSHIP||TAB(45);:PRINT USING "###.##";C3
8580 PRINT TAB(17)||RETURN TO MANAGEMENT||TAB(45);:PRINT USING "###.##";C4
8585 PRINT TAB(17)||-----||TAB(45)|_
8590 PRINT TAB(17)||TOTAL||TAB(45);:PRINT USING "###.##";C5
8600 PRINT
8615 PRINT TAB(17)||GROSS RETURN PER ACRE||TAB(45);:PRINT USING "###.##";C7
8625 PRINT TAB(17)||RETURN OVER VARIABLE COSTS||TAB(45);:PRINT USING "###.##";B4
8630 PRINT TAB(17)||RETURN OVER VARIABLE|
8640 PRINT TAB(17)||      AND FIXED COSTS||TAB(45);:PRINT USING "###.##";C6
8645 PRINT
8650 PRINT
8655 PRINT TAB(17)*****|_
8660 GOTO 9260
8665 REM      HELP FOR ECONOMIC ANALYSIS
8670 REM      HELP FOR COST OF N
8671 PRINT
8672 PRINT "Nitrogen as dry fertilizer will cost from $0.20 to $0.25 per"
8674 PRINT "Pound of actual N."
8685 GOTO 7870
8690 REM      HELP FOR COST OF P
8692 PRINT

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8694 PRINT "Phosphorus will cost from $0.22 to $0.25 per pound of P205."
8705 GOTO 7915
8710 REM      HELP FOR COST OF WILD OATS
8715 PRINT
8720 PRINT "The costs of chemicals and application are estimated to be between"
8725 PRINT "$4.00 and $5.00 per acre."
8730 GOTO 7960
8735 REM      HELP FOR BROADLEAF WEEDS
8737 PRINT
8740 PRINT "The costs of controlling broadleaf weeds are estimated to be"
8745 PRINT "between $1.00 and $3.00 per acre."
8755 GOTO 8005
8760 REM      HELP FOR MACHINERY VARIABLE COSTS
8765 PRINT
8770 PRINT "Enterprise cost studies by Montana State University have shown"
8775 PRINT "the following variable machinery costs:"
8780 PRINT TAB(10)"CROP"TAB(30)"COSTS ON RECROP"TAB(55)"COSTS ON FALLOW"
8785 PRINT TAB(27)"AVERAGE"TAB(40)"RANGE"TAB(52)"AVERAGE"TAB(65)"RANGE"
8790 PRINT TAB(6)"SPRING WHEAT"TAB(28)">$7.56"TAB(37)">$4.36-$13.42";
8792 PRINT TAB(53)">$13.00"TAB(62)">$8.19-$20.52"
8795 PRINT TAB(6)"WINTER WHEAT"TAB(28)">$6.06"TAB(37)">$3.34-$10.10";
8797 PRINT TAB(53)">$11.63"TAB(62)">$7.11-$17.20"
8800 PRINT TAB(6)"BARLEY"TAB(28)">$8.10"TAB(37)">$4.36-$17.48";
8802 PRINT TAB(53)">$13.55"TAB(62)">$8.13-24.58"
8805 PRINT TAB(6)"SAFFLOWER"TAB(28)">$6.66"TAB(37)">$6.01-$7.45";
8807 PRINT TAB(53)">$12.13"TAB(62)">$10.11-14.28"
8830 GOTO 8040
8835 REM      HELP FOR HOURS
8840 PRINT
8845 PRINT "Enterprise cost studies by Montana State University have shown"
8850 PRINT "the following labor requirements in hours per acre:"
8855 PRINT TAB(10)"CROP"TAB(30)"COSTS ON RECROP"TAB(55)"COSTS ON FALLOW"
8860 PRINT TAB(27)"AVERAGE"TAB(40)"RANGE"TAB(52)"AVERAGE"TAB(65)"RANGE"
8865 PRINT TAB(6)"SPRING WHEAT"TAB(28)>'0.96"TAB(37)'0.52-1.94";
8867 PRINT TAB(53)'1.38"TAB(62)'0.80-2.68"
8870 PRINT TAB(6)"WINTER WHEAT"TAB(28)'0.74"TAB(37)'0.20-1.55";
8872 PRINT TAB(53)'1.21"TAB(62)'0.50-2.29"
8875 PRINT TAB(6)"BARLEY"TAB(28)'0.86"TAB(37)'0.20-1.94";
8877 PRINT TAB(53)'1.32"TAB(62)'0.48-2.68"
8880 PRINT TAB(6)"SAFFLOWER"TAB(28)'0.73"TAB(37)'0.69-0.77";
8882 PRINT TAB(53)'1.23"TAB(62)'0.99-1.47"
8905 GOTO 8065
8910 REM      HELP FOR LABOR COST
8915 PRINT
8920 PRINT "Labor costs estimated in the Enterprise Cost Studies have been"
8925 PRINT "from $3.00 to $5.00 per hour."
8930 GOTO 8090
8935 REM      HELP FOR TAXES
8940 PRINT
8945 PRINT "Enterprise Cost Studies have found taxes to average about $3.50"
8950 PRINT "per acre. The range in taxes was from $1.86 to $6.51 per acre."
8955 GOTO 8250
8960 REM      HELP FOR INSURANCE
8965 PRINT
8970 PRINT "Crop and hail insurance costs averaged $4.00 per acre and ranged"
8975 PRINT "from $1.00 to $8.00 per acre in Enterprise Cost Studies."
8980 GOTO 8275
8985 REM      HELP FOR MACHINERY OWNERSHIP
8990 PRINT
8995 PRINT "Enterprise Cost Studies by Montana State University have shown"
9000 PRINT "the following fixed machinery ownership costs per acre:"
9005 PRINT TAB(10)"CROP"TAB(30)"COSTS ON RECROP"TAB(55)"COSTS ON FALLOW"
9010 PRINT TAB(27)"AVERAGE"TAB(40)"RANGE"TAB(52)"AVERAGE"TAB(65)"RANGE"
9015 PRINT TAB(6)"SPRING WHEAT"TAB(28)">$19.45"TAB(37)">$8.12-30.91";
9017 PRINT TAB(53)">$26.77"TAB(62)">$13.24-39.88"
9020 PRINT TAB(6)"WINTER WHEAT"TAB(28)">$16.74"TAB(37)">$4.10-29.54";
9022 PRINT TAB(53)">$23.68"TAB(62)">$8.88-$38.51"
9025 PRINT TAB(6)"BARLEY"TAB(28)">$19.45"TAB(37)">$4.10-$33.84";
9027 PRINT TAB(53)">$26.26"TAB(62)">$9.22-$42.81"

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9030 PRINT TAB(6)'SAFFLOWER'TAB(28)">$19.85'TAB(37)">$17.24-$23.21";
9032 PRINT TAB(53)$28.24'TAB(62)$25.56-$31.66"
9055 GOTO 8300
9060 REM      HELP FOR RETURN TO MANAGEMENT
9065 PRINT
9070 PRINT 'A usual figure for return to management is 7%.'
9075 GOTO 8325
9080 REM      HELP FOR SEEDING DATE
9082 PRINT
9085 PRINT 'Recommended seeding rates are:'
9090 PRINT TAB(10)'SPRING WHEAT'TAB(25)'45-60 LBS/A'
9092 PRINT TAB(10)'WINTER WHEAT'TAB(25)'30-60 LBS/A'
9095 PRINT TAB(10)'BARLEY'TAB(25)'45-60 LBS/A'
9100 PRINT TAB(10)'OATS'TAB(25)'40-60 LBS/A'
9105 PRINT TAB(10)'SAFFLOWER'TAB(25)'10-20 LBS/A'
9115 GOTO 7800
9120 REM      HELP FOR COST OF SEED
9125 PRINT
9130 PRINT 'The bulk (not bagged) costs of certified seed are in the following'
9135 PRINT 'approximate ranges:'
9137 PRINT TAB(10)'WINTER WHEAT'TAB(25)'$13.00 TO $20.00 CWT'
9140 PRINT TAB(10)'SPRING WHEAT'TAB(25)'$5.00 TO $7.25 CWT'
9145 PRINT TAB(10)'BARLEY'TAB(25)'$6.00 TO $10.00 CWT'
9150 PRINT TAB(10)'OATS'TAB(25)'$6.50 TO $12.00 CWT'
9155 PRINT TAB(10)'SAFFLOWER'TAB(25)'$10.00 TO $15.00 CWT'
9160 GOTO 7830
9165 REM      HELP FOR EXPECTED PRICE
9170 PRINT
9175 PRINT 'The following 'average prices received' were supplied'
9180 PRINT 'by the Statistical Reporting Service for June 1980.'
9185 PRINT TAB(10)'SPRING WHEAT'TAB(25)'$3.85'
9190 PRINT TAB(10)'WINTER WHEAT'TAB(25)'$3.37'
9195 PRINT TAB(10)'BARLEY'TAB(25)'$2.18'
9200 PRINT TAB(10)'OATS'TAB(25)'$1.55'
9202 PRINT TAB(10)'CONTRACT PRICES FOR SAFFLOWER RANGE FROM $140 TO $170/T.'
9205 GOTO 7695
9210 REM      *****
9215 REM      RESTART SECTION
9220 REM      *****
9225 RESTORE
9230 REM      ECONOMIC ANALYSIS OPTION
9235 PRINT
9240 PRINT 'Do you want to go through an economic analysis? YES or NO.'
9245 INPUT Q$
9250 IF Q$="YES" THEN 7675
9255 IF Q$="HELP" THEN 7733
9260 REM      RESTART OPTIONS
9265 PRINT
9270 PRINT
9275 PRINT 'You have completed one cycle of the program.'
9280 PRINT 'Do you want to restart the program? YES or NO.'
9285 INPUT Q$
9290 IF Q$="NO" THEN 9430
9295 IF Q$="YES" THEN CHAIN 'FLEXCROP',15
9300 IF Q$="HELP" THEN 9355
9305 GOTO 9280
9355 REM      HELP FOR RESTART
9357 PRINT
9360 PRINT 'Enter YES to restart the program with a different set of inputs.'
9365 PRINT 'Enter NO to terminate the program.'
9375 GOTO 9280
9430 END

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5 REM      VERSION COPIED ON 08-15-80
10 CHAIN "FLEXCROP"
1000 REM ****
1010 REM      WINTER WHEAT MODULE = MOD8
1015 REM ****
1020 PRINT "HELLO WINTER WHEAT LOVERS!"
1025 DIM P(13)
1030 REM      SEEDING DATE
1035 PRINT
1040 PRINT "Enter the MONTH and DAY you plan to seed the crop"
1045 PRINT "For HELP type 0,0"
1050 PRINT "Example: 9,25"
1055 INPUT Z1,Z2
1060 IF Z1=0 THEN 1085
1065 IF Z1<8 THEN 1085
1070 IF Z1>10 THEN 1085
1075 IF Z2>31 THEN 1085
1080 GOTO 1095
1085 PRINT "Please enter only 8, 9, or 10 for month and 1 to 31 for day"
1090 GOTO 1040
1095 REM CALCULATE DAY OF YEAR
1100 REM ****
1105 REM      SOIL WATER MODULE
1110 REM ****
1115 REM
1120 PRINT
1125 PRINT "A minimum of 1 FT of moist soil is recommended before seeding"
1130 PRINT "Winter Wheat to insure good stand establishment."
1135 PRINT
1140 PRINT "What is your depth of moist soil in FEET?"
1145 INPUT Q$
1150 IF Q$="HELP" THEN 1950
1155 M=VAL(Q$)
1160 IF M<1 THEN 1275
1165 GOTO 1295
1170 PRINT
1175 PRINT "Do you wish to continue with the program? YES or NO."
1180 INPUT Q$
1185 IF Q$="NO" THEN 2460
1190 IF Q$<>"YES" THEN 1275
1195 PRINT
1200 IF M<4 THEN 1310
1205 M=4
1210 PRINT
1215 REM      INPUT TEXTURE
1220 PRINT "Is your soil texture coarse, moderately coarse or medium-fine?"
1225 PRINT "Input CO, MC, MF, or HELP."
1230 INPUT T$
1235 IF T$="MF" THEN 1360
1240 REM      GET TEXTURE CONVERSION FACTOR
1245 IF T$="MC" THEN 1370
1250 IF T$="CO" THEN 1380
1255 IF T$="HELP" THEN 1820
1260 T=2
1265 GOTO 1390
1270 T=1.5
1275 GOTO 1390
1280 T=.8
1285 GOTO 1390
1290 S=M*T
1295 PRINT
1300 PRINT
1305 PRINT "Available soil water is";S;"inches."
1310 PRINT
1315 REM      EXPECTED GROWING SEASON PRECIP FOR DRYLAND SPRING GRAIN
1320 REM      INPUT LOCATION
1325 PRINT "Type the name of the nearest location with weather records."
1330 PRINT "Input LOCATION NAME, NONE, or HELP for a list of locations."
1335 PRINT "Type multiple word names without spaces."

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1440 INPUT B$
1445 IF B$="HELP" THEN 2020
1450 IF B$="NONE" THEN 1460
1455 GOTO 1520
1460 PRINT
1465 PRINT "What is your GROWING SEASON PRECIPITATION in INCHES?"
1470 INPUT Q$
1475 IF Q$="HELP" THEN 1885
1480 P=VAL(Q$)
1485 IF P>20 THEN 1885
1490 PRINT
1495 PRINT "Which CROPPING DISTRICT are you in?"
1500 INPUT Q$
1505 IF Q$="HELP" THEN 1915
1510 X3=VAL(Q$)
1515 GOTO 1785
1520 OPEN 'I',#1,"PRECIP"
1525 INPUT#1,X1,X3,X$
1530 IF EOF(1) THEN 2020
1535 FOR N=1 TO 12
1540 INPUT#1,P(N)
1545 NEXT N
1550 IF X$=B$ THEN 1560
1555 GOTO 1525
1560 IF M<3 THEN 1575
1565 P=P(4)+P(5)+P(6)
1570 GOTO 1785
1575 P(13)=P(4)+P(5)+P(6)
1580 P1=P(11)+P(12)+P(1)+P(2)+P(3)
1585 PRINT "How many DAYS AFTER AUGUST 1 was soil water measured?"
1590 INPUT Q$
1595 IF Q$="HELP" THEN 1990
1600 PRINT
1605 D1=VAL(Q$)
1606 IF L$="FALLOW" THEN 1645
1608 PRINT
1609 PRINT "Do you use a grass barrier system? YES or NO"
1610 INPUT Q$
1611 IF Q$="YES" THEN 1732
1612 IF Q$="HELP" THEN 2440
1613 IF Q$<>"NO" THEN 1608
1614 PRINT
1615 PRINT "Was the stubble incorporated or left standing? Enter TILLED or "
1620 PRINT "STANDING."
1625 INPUT R$
1627 IF R$="HELP" THEN 2450
1630 IF R$="TILLED" THEN 1645
1635 IF R$<>"STANDING" THEN 1615
1640 PRINT
1645 IF Z1=8 THEN 1745
1650 IF Z1=9 THEN 1700
1655 IF L$="FALLOW" THEN 1685
1660 IF R$="TILLED" THEN 1675
1665 W1=.33
1670 GOTO 1690
1675 W1=.25
1680 GOTO 1690
1685 W1=.12
1690 P=W1*((31-D1)/31)*P(10)+P1)+P(13)
1695 GOTO 1785
1700 IF L$="FALLOW" THEN 1730
1705 IF R$="TILLED" THEN 1720
1710 W1=.33
1715 GOTO 1735
1720 W1=.25
1725 GOTO 1735
1730 W1=.12
1731 GOTO 1735
1732 W1=.48

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1735 P=W1*((31-D1)/31)*P(9)+P(10)+P1)+P(13)
1740 GOTO 1785
1745 IF L$="FALLOW" THEN 1775
1750 IF R$="TILLED" THEN 1765
1755 W1=.33
1760 GOTO 1780
1765 W1=.25
1770 GOTO 1780
1775 W1=.12
1780 P=W1*((31-D1)/31)*P(8)+P(9)+P(10)+P1)+P(13)
1785 REM      CALCULATE TOTAL CROP WATER
1790 W=S+P
1795 PRINT
1800 PRINT "The estimated water available for crop production is";W;
1805 PRINT "inches, including growing season precipitation."
1810 GOTO 2315
1815 REM      HELP MESSAGE SECTION FOR SOIL WATER MODULE
1820 REM      HELP FOR SOIL TEXTURE
1825 PRINT
1830 PRINT "The soil texture categories are:"
1835 PRINT
1840 PRINT "COARSE (CO)"TAB(20)"fine sand (FS), loamy sand (LS)"
1845 PRINT
1850 PRINT "MOD. COARSE (MC)"TAB(20)"sandy loam (SL), fine sandy loam (FSL)"
1855 PRINT
1860 PRINT "MEDIUM-FINE (MF)"TAB(20)"loam (L), silt loam (SiL), clay loam (CL)"
1865 PRINT TAB(20)"silty clay loam (SiCL), silty clay (SiC)"
1870 PRINT TAB(20)"clay (C)"
1875 PRINT
1880 GOTO 1320
1885 REM      HELP FOR GROWING SEASON PRECIP
1890 PRINT
1895 PRINT "Enter one-half of the precipitation you expect to receive"
1900 PRINT "between seeding and March 31 plus the precipitation between"
1905 PRINT "April 1 and June 30. An average value is 7 inches."
1910 GOTO 1460
1915 REM      HELP FOR CROPPING DISTRICT
1920 PRINT
1925 PRINT "The cropping district numbers are:"
1930 PRINT TAB(5)"1. Northwest Montana"TAB(30)"4. Central Montana"
1935 PRINT TAB(5)"2. Southwest Montana"TAB(30)"5. Northcentral Montana"
1940 PRINT TAB(5)"3. Southeast Montana"TAB(30)"6. Northeast Montana"
1945 GOTO 1490
1950 REM      HELP FOR MOIST SOIL DEPTH
1955 PRINT
1960 PRINT "Moist soil depth provides a measure of the amount of stored soil"
1965 PRINT "water. For winter wheat, soil moisture should be measured prior"
1970 PRINT "to planting to make cropping decisions, seeding rates and"
1975 PRINT "fertilizer rates more accurate. Moist soil depth can be measured"
1980 PRINT "most easily with a soil moisture probe."
1985 GOTO 1235
1990 REM      HELP FOR MSD DATE
1995 PRINT
2000 PRINT "Montana State University recommends measuring soil water (moist"
2005 PRINT "soil depth) around September 15 of the crop year."
2010 PRINT
2015 GOTO 1585
2020 REM      LOCATION HELP
2025 PRINT
2030 PRINT "Weather records are available for 130 locations in Montana."
2035 PRINT "Choose the location which most closely represents your situation."
2040 PRINT "Enter LIST for a listing of locations or GO to continue with the program."
2045 INPUT Q$
2050 IF Q$="GO" THEN 1430
2055 IF Q$="LIST" THEN 2065
2060 GOTO 2040
2065 PRINT
2070 PRINT "Weather records are available for the following locations:"
2075 PRINT "(Cropping districts are in parenthesis)"

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2080 PRINT
2085 PRINT TAB(5) "ANACONDA (2)" TAB(25) "FORTINE (1)" TAB(45) "PHILLIPSBURG (2)"
2090 PRINT TAB(5) "AUGUSTA (2)" TAB(25) "FORT PECK (6)" TAB(45) "PLEASANT VALLEY (1)"
2095 PRINT TAB(5) "BABB (5)" TAB(25) "FRAZER (6)" TAB(45) "PLEVNA (6)"
2100 PRINT TAB(5) "BAKER (3)" TAB(25) "GIBSON (2)" TAB(45) "POLSON (1)"
2105 PRINT TAB(5) "BALLANTINE (3)" TAB(25) "GLASGOW (6)" TAB(45) "POPLAR (6)"
2110 PRINT TAB(5) "BARBER (4)" TAB(25) "GLENDIVE (6)" TAB(45) "RAPELJE (3)"
2115 PRINT TAB(5) "BELGRADE (2)" TAB(25) "GOLDBUTTE (5)" TAB(45) "RED LODGE (3)"
2120 PRINT TAB(5) "BIG SANDY (5)" TAB(25) "GRASSRANGE (4)" TAB(45) "ROCK SPRINGS (3)"
2125 PRINT TAB(5) "BIG TIMBER (3)" TAB(25) "GREAT FALLS (4)" TAB(45) "ROUNDUP (4)"
2130 PRINT TAB(5) "BILLINGS (3)" TAB(25) "HAMILTON (1)" TAB(45) "ROY (4)"
2135 PRINT TAB(5) "BOULDER (2)" TAB(25) "HARDIN (3)" TAB(45) "SAVAGE (6)"
2140 PRINT TAB(5) "BOZEMAN (2)" TAB(25) "HARLOWTON (4)" TAB(45) "SCOBAY (6)"
2145 PRINT TAB(5) "BRADY AZNOE (5)" TAB(25) "HAUGAN (1)" TAB(45) "SEELEY LAKE (1)"
2150 PRINT TAB(5) "BRIDGER (3)" TAB(25) "HAVRE (5)" TAB(45) "SIDNEY (6)"
2155 PRINT TAB(5) "BROWNING (5)" TAB(25) "HEBGEN DAM (2)" TAB(45) "SIMPSON (5)"
2160 PRINT TAB(5) "BRUSETT (6)" TAB(25) "HELENA (2)" TAB(45) "STEVENVILLE (1)"
2165 PRINT TAB(5) "BUSBY (3)" TAB(25) "HERON (1)" TAB(45) "STANFORD (4)"
2170 PRINT TAB(5) "BUTTE (2)" TAB(25) "HOLTER DAM (2)" TAB(45) "ST IGNATIUS (1)"
2175 PRINT TAB(5) "CASCADE (4)" TAB(25) "HUNTLEY (3)" TAB(45) "SUMMIT (1)"
2180 PRINT TAB(5) "CHINOOK (5)" TAB(25) "JOPLIN (5)" TAB(45) "SUN RIVER (4)"
2185 PRINT TAB(5) "CHOTEAU (5)" TAB(25) "JORDAN (6)" TAB(45) "SUPERIOR (1)"
2190 INPUT "Enter RETURN to continue." ; Q$
2195 PRINT TAB(5) "CIRCLE (6)" TAB(25) "KALISPELL (1)" TAB(45) "TELEGRAPH CREEK (5)"
2200 PRINT TAB(5) "COLSTRIP (3)" TAB(25) "LAKEVIEW (2)" TAB(45) "THOMPSON FALLS (1)"
2205 PRINT TAB(5) "COLUMBUS (3)" TAB(25) "LAME DEER (3)" TAB(45) "TOWNSEND (2)"
2210 PRINT TAB(5) "CONRAD (5)" TAB(25) "LEWISTOWN (4)" TAB(45) "TRIDENT (2)"
2215 PRINT TAB(5) "COOKE CITY (2)" TAB(25) "LIBBY (1)" TAB(45) "TROUT CREEK (1)"
2220 PRINT TAB(5) "CROW AGENCY (3)" TAB(25) "LIMA (2)" TAB(45) "TROY (1)"
2225 PRINT TAB(5) "CULBERTSON (6)" TAB(25) "LIVINGSTON (2)" TAB(45) "TURNER (5)"
2230 PRINT TAB(5) "CUT BANK (5)" TAB(25) "LONEPINE (1)" TAB(45) "VALIER (5)"
2235 PRINT TAB(5) "DARBY (1)" TAB(25) "LOWETH (4)" TAB(45) "VIDA (6)"
2240 PRINT TAB(5) "DEER LODGE (2)" TAB(25) "LUSTRE (6)" TAB(45) "VIRGINIA CITY (2)"
2245 PRINT TAB(5) "DENTON (4)" TAB(25) "MALTA (5)" TAB(45) "WESTBY (6)"
2250 PRINT TAB(5) "DILLON (2)" TAB(25) "MEDICINE LAKE (6)" TAB(45) "WEST GLACIER (1)"
2255 PRINT TAB(5) "DUNKIRK (5)" TAB(25) "MELSTONE (4)" TAB(45) "WEST YELLOWSTONE (2)"
2260 PRINT TAB(5) "EAST ANACONDA (2)" TAB(25) "MILDRED (6)" TAB(45) "WHITEFISH (1)"
2265 PRINT TAB(5) "EKALAKA (3)" TAB(25) "MILES CITY (3);"
2270 PRINT TAB(45) "WHITE SULPHUR SPRINGS (2)"
2275 PRINT TAB(5) "ENNIS (2)" TAB(25) "MISSOULA (1)" TAB(45) "WIBAUX (6)"
2280 PRINT TAB(5) "FAIRFIELD (5)" TAB(25) "MISSOULA WEST (1)" TAB(45) "WINIFRED (4)"
2285 PRINT TAB(5) "FLAXVILLE (4)" TAB(25) "MOCCASIN (4)" TAB(45) "WINNETT (4)"
2290 PRINT TAB(5) "FORKS (5)" TAB(25) "MYSTIC LAKE (3)" TAB(45) "WISDOM (2)"
2295 PRINT TAB(5) "FORSYTH (3)" TAB(25) "NORRIS (2)" TAB(45) "WOLF POINT (6)"
2300 PRINT TAB(5) "FORT ASSINIBOINE (5)" TAB(25) "OVANDO (2)" TAB(45) "WYOLA (3)"
2305 PRINT TAB(5) "FORT BENTON (5)" TAB(25) "PENIROY (5)"
2310 GOTO 1430
2315 REM      CALCULATE BASE YIELD
2320 Y=6.5*(W)-39.8
2325 IF L$="FALLOW" THEN 2340
2330 Y=(Y-(-.1*Y+9))
2335 GOTO 2340
2340 Y=INT(Y*10+.5)/10
2345 IF Y<=0 THEN 2405
2350 PRINT "YOUR BASE YIELD IS ";Y;" BUSHELS PER ACRE."
2355 PRINT
2360 IF L$<>"W WHEAT" THEN 2375
2365 Y7=INT(Y*.95)
2370 GOTO 2385
2375 Y7=Y
2380 GOTO 2430
2385 PRINT
2390 PRINT "FOLLOWING WHEAT WITH WHEAT REDUCED THE BASE YIELD FROM ";Y
2395 PRINT "TO ";Y7;" BUSHELS PER ACRE."
2400 GOTO 2430
2405 REM      THIS GOODIE PREVENTS NEGATIVE YIELDS
2410 PRINT
2415 PRINT "YOUR YIELD IS ZERO BUSHELS PER ACRE DUE TO VERY LOW AVAILABLE"
2420 PRINT "WATER. YOU WILL HAVE TO START THE PROGRAM OVER."

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2425 CHAIN "FLEXCROP"
2430 REM      CHAIN TO VARIETY
2435 CHAIN "MOD9",1000,ALL
2440 REM      HELP FOR GRASS BARRIERS
2445 GOTO 1608
2450 REM      HELP FOR TILLED OR STUBBLE
2455 GOTO 1614
2460 END

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10 CHAIN "FLEXCROP"
1000 REM      *****
1005 REM      VARIETY SELECTION = MOD9
1010 REM      *****
2000 DIM K(12)
2005 DATA 1.166,1.0,1.002,0.924,1.065,0.932,0.975,0.979
2010 DATA 1.024,1.018,0.973,1.00
2015 FOR I=1 TO 12
2020 READ K(I)
2025 NEXT I
2030 PRINT "The recommended winter wheat varieties for your area are:"
2035 IF X3=1 THEN 2130
2040 IF X3=2 THEN 2130
2045 IF X3=3 THEN 2115
2050 IF X3=4 THEN 2095
2055 IF X3=5 THEN 2080
2060 PRINT " 4. FROID    6. MINTER    7. ROUGH RIDER*   10. WINALTA"
2065 PRINT " 20. OTHER    (*= Daniels, Richland, Roosevelt, and"
2070 PRINT "           Valley Counties only)"
2075 GOTO 2135
2080 PRINT " 1. CENTURK   2. CHEYENNE   4. FROID    9. WARRIOR"
2085 PRINT " 10. WINALTA   11. WINOKA    20. OTHER"
2090 GOTO 2135
2095 PRINT " 1. CENTURK   2. CHEYENNE   3. CREST*   9. WARRIOR"
2100 PRINT " 10. WINALTA   11. WINOKA    20. OTHER"
2105 PRINT "           (*= Dwarf smut infested areas only)"
2110 GOTO 2135
2115 PRINT " 1. CENTURK   2. CHEYENNE   3. CREST*"
2120 PRINT " 5. LANCER    8. TRAPPER    9. WARRIOR"
2125 GOTO 2100
2130 PRINT " 3. CREST*   20. OTHER"
2132 GOTO 2105
2135 REM      ENTER VARIETY SELECTION
2140 PRINT
2145 PRINT "Type the NUMBER of the variety you want to plant."
2150 INPUT Q$
2155 IF Q$="HELP" THEN 2900
2160 J=VAL(Q$)
2165 IF J=20 THEN 2180
2170 Y2=INT(Y7*K(J)*10)/10
2175 GOTO 2185
2180 Y2=Y7
2185 PRINT
2190 PRINT "YOUR YIELD IS NOW ";Y2;" BUSHELS PER ACRE."
2195 V=2
2200 GOTO 3000
2900 REM      HELP FOR WINTER WHEAT VARIETY SELECTION
2902 PRINT
2905 PRINT "Varieties vary in their yielding ability. The relative yield of"
2910 PRINT "each variety was calculated using Cheyenne as the check variety."
2920 GOTO 2135
3000 REM      CHAIN TO WEED CONTROL
3005 CHAIN "MOD5A",3630,ALL

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Appendix B: Location of weather recording stations, cropping districts, and long-term average monthly precipitation for Montana locations accessed in the FLEXCROP program

Location	Cropping district	Month											
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Anaconda	2	0.73	0.66	0.93	0.86	1.60	2.40	1.20	0.93	1.22	0.85	0.82	0.79
Augusta	2	.46	.50	.87	.98	2.05	3.13	1.26	1.16	1.34	.75	.59	.49
Babb	5	.80	.90	1.16	1.54	2.58	4.25	1.66	1.64	2.07	1.28	.99	.95
Baker	3	.39	.40	.48	1.22	1.66	3.43	2.07	1.39	1.33	.62	.43	.32
Baillantine	3	.43	.46	.86	.92	1.69	2.59	.84	.88	1.14	.97	.45	.48
Barber	4	.41	.37	.56	.79	2.26	3.13	1.24	1.13	1.20	.69	.49	.38
Belgrade	2	.66	.41	.87	1.16	2.10	2.67	1.10	1.15	1.39	1.00	.81	.59
BigSandy	5	.27	.32	.67	.82	1.90	3.06	1.40	1.22	1.05	.55	.43	.49
BigTimber	3	.48	.50	1.13	1.34	2.37	2.52	.94	1.02	1.48	1.13	.64	.56
Billings	3	.53	.44	.93	1.05	1.80	2.61	1.14	.88	1.32	1.14	.68	.58
Boulder	2	.52	.33	.46	.76	1.56	2.50	1.11	1.09	1.09	.53	.51	.50
Bozeman	2	.92	.76	1.53	1.73	2.34	3.06	1.08	1.12	1.65	1.45	1.07	.91
BradyAznoe	5	.30	.29	.49	.86	2.17	3.08	1.33	1.09	.91	.50	.39	.33
Bridger	3	.49	.32	.68	1.39	1.75	2.24	.62	.79	1.26	.79	.59	.41
Broadus	3	.51	.46	.70	1.39	2.23	3.13	1.36	1.08	1.20	.86	.65	.48
Browning	5	.76	.64	.81	1.00	1.90	3.41	1.37	1.14	1.42	.93	.73	.74
Brusett	6	.47	.39	.63	1.16	1.86	3.11	1.64	1.49	1.21	.79	.41	.34
Busby	3	.39	.29	.65	1.06	2.02	2.43	1.07	1.05	1.16	.91	.49	.40
Butte	2	.59	.53	.78	1.04	1.80	2.28	1.24	1.12	1.20	.79	.69	.61
Cascade	4	.43	.51	.86	1.15	2.40	3.41	1.21	.98	1.45	1.03	.57	.47
ChInook	5	.50	.43	.68	.93	1.76	3.21	1.45	1.30	1.12	.66	.44	.56
Choteau	5	.21	.30	.47	.70	2.12	3.05	1.38	1.05	1.12	.57	.28	.23
Circle	6	.26	.22	.37	.91	1.53	3.15	1.86	1.23	.93	.65	.29	.27
Colstrip	6	.62	.62	1.07	1.60	2.30	2.96	1.28	1.17	1.29	1.24	.59	.59
Columbus	3	.42	.36	.91	1.31	2.40	2.91	.83	.75	1.35	1.17	.57	.50
Conrad	5	.32	.44	.68	1.02	1.72	3.04	1.65	1.05	1.09	.59	.32	.38
CookeCity	2	2.47	1.84	1.93	1.97	2.72	3.32	1.99	1.95	2.22	1.68	2.24	2.28
CrowAgency	3	.56	.63	1.29	1.63	2.03	2.59	.91	.90	1.41	1.29	.65	.76
Culbertson	6	.36	.28	.46	.99	1.68	3.47	1.83	1.47	1.09	.76	.39	.33
Cutbank	5	.38	.36	.48	.74	1.73	2.85	1.31	1.15	1.20	.55	.32	.34
Darby	1	1.33	1.32	1.14	.94	1.75	1.91	.86	.75	1.27	1.20	1.65	1.67
DeerLodge	2	.40	.33	.54	.65	1.52	2.21	1.21	.79	.93	.64	.55	.51
Denton	4	.68	.56	.68	.99	2.75	3.40	1.53	1.32	1.23	.79	.74	.66
Dillon	2	.46	.47	.72	1.13	1.79	2.13	1.24	.83	1.10	.77	.47	.45
Dunkirk	5	.36	.41	.54	.82	1.56	2.69	1.43	1.25	1.08	.58	.35	.47
EastAnaconda	2	.33	.28	.62	.71	1.48	2.16	1.02	.68	1.08	.51	.50	.44
Ekalaka	6	.42	.33	.67	1.16	1.97	2.85	1.87	1.38	1.09	.77	.40	.36
Ennis	2	.26	.24	.44	.94	1.57	2.57	1.15	.95	1.11	.76	.31	.28
Fairfield	5	.23	.28	.49	.68	1.99	3.19	1.31	1.10	1.14	.64	.33	.23
Flaxville	4	.28	.36	.69	.83	1.97	3.24	1.37	1.17	1.01	.94	.40	.39
Forks	5	.33	.26	.37	.98	1.63	3.09	1.63	1.41	.91	.52	.27	.25
Forsyth	3	.28	.31	.50	1.30	1.90	2.97	1.23	1.05	1.06	.70	.48	.35
FortAssinibonne	5	.34	.32	.56	.89	1.54	2.80	1.42	1.20	1.00	.64	.31	.39
FortBenton	5	.75	.65	.84	1.21	2.25	3.21	1.36	1.07	1.18	.84	.70	.72
Fortine	1	1.48	1.02	1.13	1.23	1.66	2.51	1.20	1.34	1.29	1.54	1.48	1.65
FortPeck	6	.34	.30	.41	.91	1.59	2.83	1.54	1.50	.95	.57	.35	.23
Frazer	6	.51	.45	.78	1.07	1.58	3.34	1.69	1.35	1.10	.73	.46	.42
Gibson	2	.70	.60	.96	1.21	2.61	3.55	1.39	1.35	1.83	1.21	.93	.90
Glasgow	6	.40	.34	.60	1.00	1.55	3.48	1.47	1.33	1.22	.80	.52	.53
Glendive	6	.39	.40	.66	1.08	1.64	3.21	1.76	1.57	.92	.76	.36	.32
GoldButte	5	.31	.31	.43	.87	1.91	3.45	1.52	1.31	1.38	.66	.38	.37
GrassRange	4	.63	.47	.81	1.36	3.04	3.77	1.61	1.40	1.49	.83	.64	.50
GreatFalls	4	.55	.57	.99	.95	1.93	2.96	1.35	1.20	1.44	.72	.67	.70
Hamilton	1	.86	.92	.65	.66	1.61	1.91	.79	.62	1.06	1.00	1.03	1.05
Hardin	5	.49	.48	.70	.79	1.64	3.31	1.59	1.17	.95	.60	.44	.52
Harlowton	4	.41	.38	.55	.80	2.25	3.23	1.28	1.05	1.23	.68	.48	.41
Haugan	1	4.32	3.34	2.99	1.73	1.56	2.15	.75	.68	1.62	2.77	3.88	4.68
Havre	5	.46	.39	.70	.90	1.48	2.98	1.47	1.06	1.15	.68	.48	.56
Haxby	6	.43	.30	.75	1.18	1.74	3.47	1.33	1.42	1.12	.76	.41	.46
HebgenDam	2	2.80	2.39	2.39	1.57	2.33	2.93	1.56	1.30	1.45	1.75	2.45	2.85

Appendix B: Location of weather recording stations, cropping districts, and long-term average monthly precipitation for Montana locations accessed in the FLEXCROP program—Continued

Location	Cropping district	Month											
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Helena	2	.51	.41	.72	.88	1.60	2.15	.98	.93	1.16	.68	.64	.64
Heron	1	4.56	3.72	3.35	2.00	2.12	2.65	.76	.86	1.76	3.19	4.26	5.15
HolterDam	2	.56	.48	.72	1.03	2.14	3.05	1.12	.79	1.23	.74	.51	.51
Huntley	3	.37	.45	.81	1.00	1.82	2.53	.79	.80	1.13	1.00	.44	.48
Joplin	5	.32	.30	.33	.80	1.61	2.73	1.46	1.12	.95	.45	.35	.30
Jordan	6	.37	.27	.45	1.08	1.66	2.70	1.53	1.14	.98	.60	.33	.31
Kalispeii	1	1.32	.92	1.01	1.02	1.63	2.43	1.16	1.11	1.30	1.36	1.55	1.54
Lakeview	2	1.70	1.19	1.60	1.48	2.58	3.28	1.22	1.43	1.48	1.45	1.55	1.56
LameDeer	3	.66	.63	.87	1.58	2.59	3.39	1.29	1.23	1.33	1.07	.85	.74
Lewiston	4	.57	.60	.94	1.03	2.58	4.00	1.61	1.51	1.49	1.11	.71	.75
Libby	1	2.42	1.55	1.25	1.12	1.57	1.84	.68	1.05	1.28	1.92	2.37	2.35
Lima	2	.27	.26	.50	.90	1.88	2.37	1.10	1.16	1.06	.66	.36	.33
Livingston	2	.50	.48	.92	1.15	1.92	2.27	.99	1.09	1.47	1.09	.65	.65
LonePine	1	1.05	.79	.69	.68	1.03	1.67	.61	.58	.89	1.02	1.15	1.11
Loweth	4	.48	.50	.70	.94	1.98	2.84	1.35	1.15	1.44	.92	.71	.65
Lustre	6	.33	.26	.40	1.04	1.46	3.21	1.60	1.74	.95	.60	.32	.24
Malta	5	.42	.39	.69	.82	1.69	3.09	1.43	1.37	1.03	.71	.51	.43
MedicineLake	6	.43	.39	.37	1.24	1.78	3.45	2.12	1.68	1.17	.71	.51	.33
Meltone	4	.43	.37	.72	.88	1.77	3.03	1.24	.84	.93	.89	.41	.52
Mildred	6	.38	.30	.59	1.12	1.88	2.90	1.72	1.31	.92	.84	.42	.36
MilesCity	3	.47	.36	.70	1.08	1.71	2.84	1.41	1.10	1.20	.94	.49	.51
Missoula	1	.86	.74	.64	.91	1.80	2.05	.91	.68	1.02	.91	.91	1.13
MissoulaWest	1	.81	.82	.83	.90	1.64	1.87	.83	.78	1.07	1.07	1.11	1.03
Moccasin	4	.41	.43	.64	.96	2.18	3.50	1.43	1.45	1.31	.78	.48	.48
MysticLake	3	1.31	1.15	2.51	2.51	3.13	3.50	1.99	1.79	2.16	1.52	1.28	1.22
Norris	2	.74	.72	1.31	1.87	2.43	3.02	1.35	1.11	1.68	1.39	.83	.76
Ovando	2	1.51	1.22	1.12	.66	1.76	2.33	1.03	.80	1.14	1.16	1.38	1.74
Pendroy	5	.53	.47	.60	1.21	2.40	3.51	1.42	1.30	1.20	.58	.57	.49
Philipsburg	2	.83	.60	.94	1.16	2.01	3.15	1.17	1.21	1.23	1.02	.81	.80
PleasantValley	1	1.97	1.51	1.33	1.17	1.40	2.14	1.01	.91	1.15	1.84	2.13	2.25
Plevna	6	.42	.38	.62	1.49	1.81	3.13	1.66	1.26	.99	.88	.40	.35
Poison	1	.96	.90	.90	1.15	1.76	2.30	.98	.86	1.23	1.27	1.16	1.19
Popiar	6	.33	.32	.51	.93	1.55	3.23	2.36	1.47	.92	.67	.36	.31
Rapelje	3	.47	.43	.86	1.00	2.09	2.87	1.04	1.02	1.16	1.05	.45	.40
RedLodge	3	.83	.77	1.73	2.33	3.08	3.34	1.38	1.09	1.86	1.47	.91	.69
RockSprings	3	.32	.29	.43	.96	1.68	2.81	1.45	1.05	1.04	.54	.34	.31
Roundup	4	.27	.31	.61	.69	1.82	2.54	1.18	.87	.96	.89	.32	.37
Roy	4	.45	.40	.54	1.06	2.50	3.33	1.52	1.29	1.17	.76	.49	.37
Savage	6	.41	.33	.57	.98	1.63	3.27	2.17	1.58	1.14	.70	.38	.28
Scobey	6	.58	.50	.60	.99	1.67	3.04	1.72	1.76	1.22	.62	.42	.50
SeeiyLake	1	2.87	1.89	1.58	1.42	2.03	2.53	1.03	1.01	1.44	1.51	2.26	2.71
Sidney	6	.41	.37	.47	1.21	2.01	2.90	1.76	1.67	1.23	.79	.42	.40
Sliveriake	2	1.08	.92	1.50	1.79	2.54	3.44	1.36	1.29	1.57	1.24	1.07	.95
Simpson	5	.35	.27	.29	.69	1.30	2.55	1.31	1.11	.92	.42	.29	.26
Stevensville	1	1.06	1.00	.85	.73	1.47	1.74	.93	.66	.93	.91	1.13	1.23
Stanford	4	.53	.57	.74	.97	2.40	3.55	1.78	1.52	1.30	.80	.59	.59
Stignatius	1	.76	.76	1.04	1.30	2.13	2.54	.97	.99	1.19	1.10	.99	.89
Summit	1	4.81	3.80	3.18	2.93	3.04	3.97	1.28	1.62	2.58	3.21	4.29	4.51
SunRiver	4	.48	.40	.67	1.03	2.34	3.09	1.36	.97	1.05	.57	.49	.39
Superior	1	1.70	1.22	1.13	1.03	1.60	2.09	.75	.72	1.03	1.41	1.56	1.67
TelegraphCreek	5	.46	.33	.47	1.04	1.63	2.83	1.34	1.27	1.14	.71	.41	.41
ThompsonFalls	1	2.12	1.65	1.87	1.41	1.73	1.99	.81	.74	1.24	2.06	2.26	2.46
Townsend	2	.49	.26	.52	.85	1.83	2.46	1.08	1.07	1.20	.70	.51	.47
Trident	2	.38	.26	.60	1.04	1.95	2.58	1.05	1.16	1.25	.70	.49	.33
TroutCreek	1	4.54	3.21	2.56	1.99	2.03	2.24	.88	1.13	1.61	2.65	3.86	4.16
Troy	1	4.52	3.34	3.00	1.82	1.70	2.09	.92	.83	1.45	2.86	3.88	4.84
Turner	5	.38	.31	.38	.80	1.47	3.13	1.81	1.38	1.06	.54	.31	.25
Vailler	5	.27	.32	.55	.92	1.92	3.66	1.59	1.05	1.18	.65	.36	.36
Vida	6	.77	.56	.95	1.36	1.78	3.65	2.00	1.40	1.13	.95	.88	.66

Appendix B: Location of weather recording stations, cropping districts, and long-term average monthly precipitation for Montana locations accessed in the FLEXCROP program—Continued

Location	Cropping district	Month											
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
VirginiaCity	2	.68	.51	1.02	1.39	1.71	2.57	1.33	1.09	1.19	.86	.76	.68
Westby	6	.58	.56	.51	1.06	1.91	3.21	2.03	2.07	1.16	.68	.47	.49
WestGlacier	1	3.12	2.35	1.83	1.77	2.41	3.05	1.39	1.31	1.84	2.68	2.87	3.33
WestYellowstone	2	2.20	1.79	1.94	1.38	2.01	2.55	1.28	1.19	1.17	1.59	1.78	2.27
Whitefish	1	2.33	1.81	1.38	1.53	2.36	3.38	1.18	1.55	1.61	1.69	2.15	2.18
WhiteSulphurSprings	2	1.00	1.15	1.73	1.38	2.35	3.41	1.39	1.36	1.52	1.17	1.16	1.21
Wibaux	6	.36	.30	.51	1.25	1.96	3.38	2.17	1.59	1.33	.66	.44	.24
Winifred	4	.43	.39	.83	.72	1.70	3.11	1.59	1.04	1.19	.89	.52	.62
Winnett	4	.50	.38	.57	1.02	2.19	3.02	1.54	1.18	1.14	.69	.42	.44
Wisdom	2	.75	.57	.69	.82	1.78	2.16	.83	1.04	1.08	.89	.83	.82
WolfPoint	6	.50	.40	.52	1.17	1.61	3.27	2.03	1.80	1.07	.58	.45	.38
Wyola	3	.77	.67	1.04	2.11	2.45	2.75	.92	.93	1.52	1.09	.88	.73

Appendix C: References Used for Economic Module

(1) Fogle, V., and L. Luft. 1979. Costs of dryland crop production in Hill County. Montana State University, Cooperative Extension Bulletin No. 1138 (Revised), 4 p.

(2) _____ and L. D. Luft. 1979. Costs of dryland crop production in Chouteau County. Montana State University, Cooperative Extension Bulletin No. 1140 (Revised), 5 p.

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(4) _____ and L. Luft. 1979. Costs of irrigated crop production in the Bitterroot Valley. Montana State University, Cooperative Extension Bulletin No. 1165 (Revised), 7 p.

(5) _____ and L. D. Luft. 1979. Costs of dryland crop production in Toole County. Montana State University, Cooperative Extension Bulletin No. 1168 (Revised), 5 p.

(6) _____ D. Griffith, and L. D. Luft. 1979. Enterprise costs for fallow, winter wheat, spring wheat, and barley in Fallon and Carter Counties. Montana State University, Cooperative Extension Bulletin No. 1217, 22 p.

(7) _____ D. Griffith, and L. D. Luft. 1979. Enterprise costs for fallow, winter wheat, and barley in Rosebud and Treasure Counties. Montana State University, Cooperative Extension Bulletin No. 1218, 18 p.

(8) _____ D. Griffith, and L. D. Luft. 1979. Enterprise costs for fallow, winter wheat, and barley in Big Horn County. Montana State University, Cooperative Extension Bulletin No. 1219, 18 p.

(9) _____ D. Griffith, and L. D. Luft. 1979. Enterprise costs for fallow, winter wheat, and recrop barley in Cascade County. Montana State University, Cooperative Extension Bulletin No. 1220, 18 p.

(10) _____ D. Griffith, and L. D. Luft. 1979. Enterprise costs for fallow, winter wheat, spring wheat after barley, and recrop barley in Flathead County. Montana State University, Cooperative Extension Bulletin No. 1221, 22 p.

(11) Griffith, D., V. Fogle, and L. D. Luft. 1979. Enterprise costs for fallow, winter wheat, barley, and recrop barley in Judith Basin County. Montana State University, Cooperative Extension Bulletin No. 1210, 22 p.

(12) Haynes, G., and D. Griffith. 1979. Summary of enterprise costs for different size irrigated farms. Montana State University, Cooperative Extension Bulletin No. 1216, 25 p.

Appendix D: FLEXCROP Variables Used in BASIC Program

Variable	Comment
Plant Available Water	
M	Moist soil depth in feet.
T\$	Soil texture (coarse, medium-coarse, medium-fine).
T	Inches of plant-available-water per foot of moist soil for given texture.
S	Inches of plant-available-water in soil.
B\$	Location name – user input.
X\$	Location name – in “WEATHER” file.
P(1)-P(12)	Mean monthly precipitation in “WEATHER” file.
D1	Days after April 1 or August 1 soil water measured.
W	Total crop water supply.
X3	Cropping district.
P	Estimate of growing season precipitation.
X1	Latitude.
P1	Overwinter precipitation estimate for winter wheat.
R\$	Stubble factor for winter wheat.
W1	Percentage of overwinter precipitation assumed to be available for plant growth.
W	Estimate of total plant-available-water for winter wheat.
Crop and Variety	
L\$	Previous crop.
C\$	Crop to be grown.
K(1)-K(35)	Yield factors for each variety.
J	User variety selection.
Yield	
Y	Yield based on water supply.
Y7	Yield after rotation.
Y2	Yield after variety selection.
Y3	Yield after wild oat control.
Y4	Yield after broadleaf weed control.
Y5	Yield after fertilization.
Y6	Yield after seeding date-final yield.
Weed Control	
A\$	Wild oat control factor.
V5	Crop factor for wild oat equation.
B\$	Level of broadleaf weed infestation.
J\$	Broadleaf weed control factor.
Soil Fertility	
V	Nitrogen requirement per unit of yield.
F2	Phosphorus application rate.
P8	Soil test level after phosphorus application.
R	Yield reduction factor.
X\$	Bray or Bicarb soil test.
V9	Bray phosphorus level.
P5	Bicarb phosphorus level.
P6	Phosphorus recommendation (broadcast).
P7	Banded phosphorus fertilizer recommendation.
P9	Phosphorus rate carried to economic module.
F, F6	Nitrogen recommendation, no soil test.
F1	Nitrogen application rate.

Appendix D: FLEXCROP Variables Used in BASIC Program—Continued

<i>Variable</i>	<i>Comment</i>
Soil Fertility—Continued	
F5	Nitrogen application carried to economics module.
N1	NO ₃ -N soil test level.
N3	Nitrogen recommendation, with soil test.
D\$	Band or broadcast or split phosphorus.
E\$	Amount of soil test information.
F3	Band phosphorus application rate.
F4	Broadcast phosphorus application rate equivalent to banded rate.
Seeding Date	
Z1	Month.
Z2	Day of month.
Z3	Day of year.
Z5	Bushels of yield lost for late seeding.
Z6	Yield factor for fertility level.
Yield Summary	
E1	Yield change due to variety selection.
E2	Yield change due to weed control.
E3	Yield change due to fertility.
E4	Yield change due to seeding date.
E5	Yield change due to rotation.
Other Variables	
Q\$	Response to questions, not carried through program.
Economics	
P1	Harvest price.
A1	Seeding rate (pounds/acre).
A2	Cost of seed (dollars/hundred weight).
B1	Seed cost (A1 x A2) per acre.
A3	Cost of nitrogen (dollars/pound).
A4	Cost of nitrogen per acre.
A5	Cost per pound of P ₂ O ₅ .
A6	Cost of P ₂ O ₅ per acre.
A7	Cost per acre wildoat control.
A8	Cost per acre for broadleaf control.
B3	Total cost per acre for weed control.
A9	Variéble machinery cost.
B8	Hours per acre.
B9	Labor cost per hour.
B7	Total labor cost per acre (B8 x B9).
C1	Taxes per acre.
C2	Insurance per acre.
C3	Machinery ownership.
C4	Return to management (percent).
B5	Total variable costs.
C5	Total fixed costs.
C7	Gross return per acre.
B4	Return over variable costs.
C6	Return over variable and fixed costs.

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